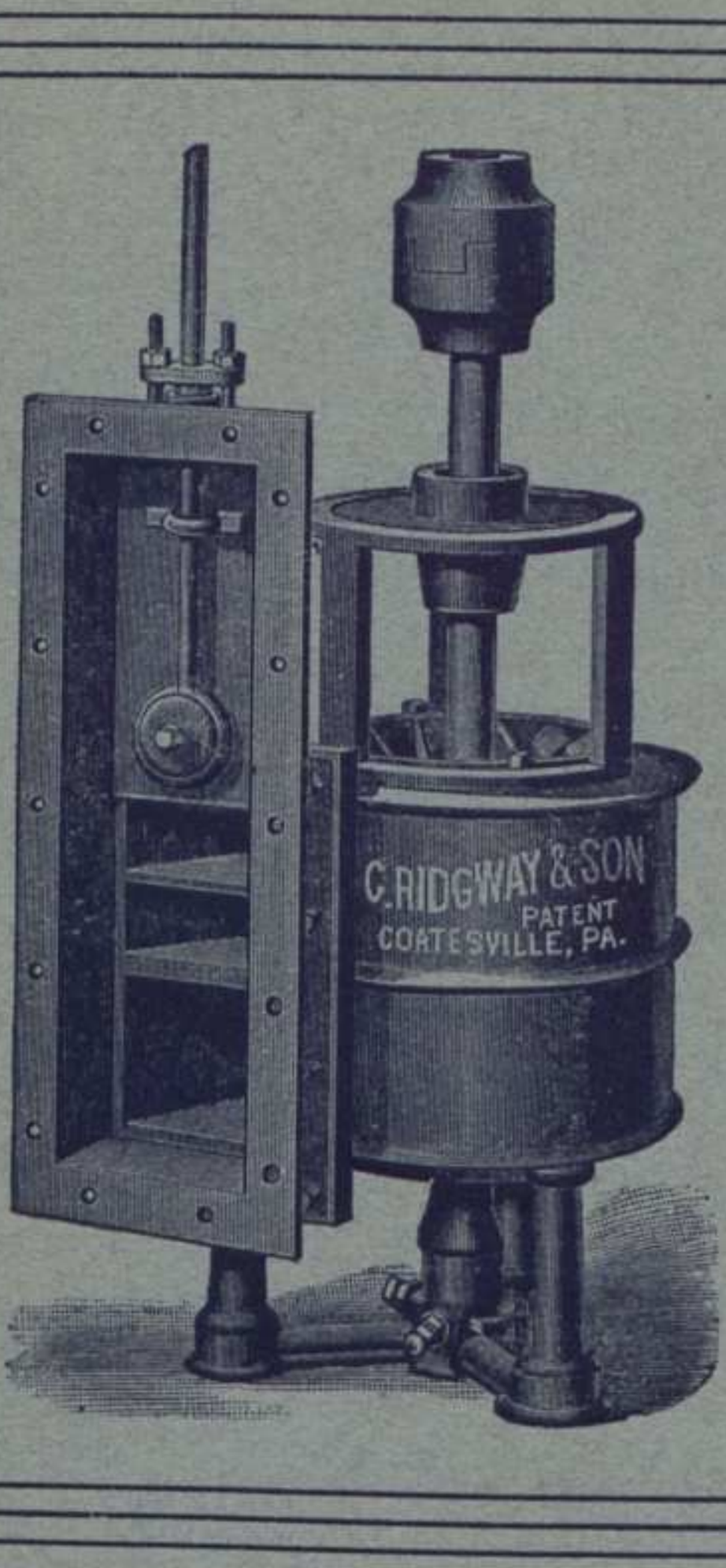
VF Waterwheel



"Perfection" Water-Wheel

The King of Turbines

The Great Water Saver

CRAIG RIDGWAY & SON CO.

COATESVILLE, PA.
U. S. A.

What the "Perfection" is For.

The mission of the "Perfection" is to **improve** water-powers. Not only to drive a mill, but to drive that mill with the least possible quantity of water.

Unless you can make your power better, unless you can economize your water, it is best that you should not undertake the putting in of a new water-wheel. Many people buy turbines to take the place of their old wheels, and, when they start up, find to their chagrin they are but little better off than they were before; indeed, many find they are worse off and in their hearts often wish they had their old wheel back and the money they have spent safe in their pocket again.

Since the introduction of the "Perfection," many hundreds of water-powers have been **improved** by it. These powers are in every State in the Union and in foreign countries, and can be visited and the performance of the wheels fully observed. In a separate circular we print many hundreds of letters from these users, in order that they may be corresponded with or the mills visited.

As has been intimated, we do not care to touch a water-power unless we can improve it. To be able to always do this it is necessary to have a variety of styles with which to suit exactly every location. One style is best suited to one place and another style to another place. We make, therefore, two kinds of Perfections:

The Standard "Perfection."
The Double "Perfection."

The Standard or Single "Perfection" is modified into several styles.

The Double "Perfection" is made vertical and horizontal.

For the "Perfection" we make wonderful claims. That it does all we say it will, there need be no question whatever. The corner-stone of our water-wheel business is this:

No responsible mill-owner need pay for the "Perfection" until he sets it up in his mill and it does all we say it will before his own eyes and to his satisfaction.

We can imagine no fairer offer than this.

To the many hundreds who now have the "Perfection" wheels and to the many who are now getting them as fast as we can make them, we return thanks for the confidence they have shown in us. We believe, however, you are well rewarded by your finely improved powers, yet we are not insensible to the benefit we have derived from your good words. It is you who have given the "Perfection" its great reputation for excellence.

CRAIG RIDGWAY & SON CO.

Puzzled Mill Owners.

If you are a wise man you want to put in the very best water-wheel you can get. What probably troubles you just now is to determine which is the best. You no doubt have half-a-dozen circulars of as many wheels, every one of which is better than all the others—according to the circulars. The assertion of each is amply backed up by hundreds of glowing testimonials and with scientific tests ranging from 85 to 92 per cent.

Now there are four principal things you want in your turbine:

1st. Economy in the use of water, *when water is lowest and scarcest.*
2d. Tight gate.
3d. Durability.
4th. Freedom from clogging.

Every wheel builder will try to tell you these things are only found in his particular wheel, notwithstanding it only gives a good percentage when gates are wide open or nearly so, and at half gate he cannot promise you half power; notwithstanding that it has from 6 to 24 openings to keep tight, and the gate rigging is made up of rings, hinges, rods, levers, cams, cog gears, worms, etc., etc. You know very well, if you know as much as a child about machinery, that such wheels would be hard enough to keep in order if set up in the dry of the mill; what can you reasonably expect of them when stuck down under water out of sight? Every experienced mill-owner will tell you they leak like riddles when new, and in use rapidly grow worse.

Note the "Perfection." It is the only water-wheel on the market that will give the same high percentage at half as at full gate, so when water is low you get high results when high results are most needed. Its gate is tight and you know such a gate stays tight. It is so extremely simple that the only trouble is that you are afraid it cannot be as good as the other wheels because it is so very simple. It sets out where you can always see it and get at it, and it saves you a good deal of money, because you do not have to build a costly penstock or buy an iron case.

You can soon satisfy yourself as to its efficiency by visiting places where they are in use and measure the water used and the work done. Besides you cannot be deceived in any way, for you do not have to pay for "Perfections" until you try them and they do in your own mill, before your own eyes, exactly what we say they will do.

Because we do not claim the "Perfection" to give 90 per cent. you must not think it is less efficient than other wheels. Almost all our small wheels will occasionally give 85 per cent., but they are often apt to give 80 per cent., and rather than disappoint you, we only promise and guarantee you 80 per cent. We have our 80 per cent. wheels running side by side, or in place of the 85 to 90 per cent. wheels, and always doing as well, but generally much better. Read our next article, and you will discover why that is so.

High Percentages.

The "Perfection" has been tested like all the rest of good wheels. An ordinary 30 inch wheel, such as we make for sale and not for show, after lying out in the rain for a long while, was put in the flume and tested by Mr. Emerson. It gave 82 per cent. Several more have been tested, and the lowest test ever obtained is 80½ per cent. So we give a written guarantee with every wheel that it will give 80 per cent. We have tests of the smaller sizes as high as 85 and 86 per cent., but we only claim for them 80 per cent.

There is hardly another wheel for sale to-day, that makes so modest a claim. All of them are loudly claimed by their builders to give from 85 to 90 per cent. Why is it, then, we claim and guarantee only 80 per cent., yet we say we have the most efficient and economical wheel in the world?

We will tell you why, and perhaps tell you a few things you don't know.

Notwithstanding the great claims and high tests of wheel-makers, there is not one single solitary water-wheel built, that can be depended upon to give over 80 per cent. in the practical driving of the mill.

Even in the testing flume where everything is perfectly arranged and the wheels have everything in their favor, and are themselves fitted up with extra care on purpose for the tests, even then they hardly give 80 per cent. We can positively assure you, that when you buy one of these wheels, you don't get one as good as the one made expressly to be tested. Let us take the report of tests made at Holyoke, and examine into some of these turbines that are sold on high per cent. tests.

The Risdon Wheel, Mount Holly, N. J., is one of those loudly claimed to give from 85 to 90 per cent. A 43 inch wheel was sent to Mr. Emerson, tested, and reported as giving 91 per cent. Mr. Risdon widely advertised his turbine as a 90 per cent. wheel, and got enormous prices for them. The report of this test caused Mr. Otto Troost, a miller of Winona, Minn., to order one exactly like it in size and every particular *The order was to get one as good, let the cost be what it would.*

Mr. Risdon built one from the same patterns, and as there was no limit to cost, no care and pains were spared in making and fitting up. This wheel when tested, however, was found to give only 82 per cent. It was taken out and sent to a machine shop for alterations, and was brought back and again tested, and gave this time only 81.68 per cent. It was taken out and doctored, and once more tested, giving this time 81.19 per cent. It was taken out and doctored for a third time, but still it only gave, when put back and tested, 81.31 per cent. A good way off from 91 per cent.! Now, if this builder could not give over 81 per cent., when he had no limit to price, and was told to take all possible pains, what assurance does a mill-owner have who buys one of these wheels, such as are made for his mill and not for the testing flume, that he is going to get a wheel that will give him over 80 per cent.

A 24 inch Hercules Wheel was tested and reported to give 89 per cent. and wonderful results. Ye. large numbers of these wheels since tested, have not given over 75 per cent., and we have in our yard one of these same 24 inch 89 per cent. wheels, only used one year, that was taken out and replaced by a 24 inch 80 per cent. "Perfection." We will sell you an 89 per cent. wheel as good as new, cheap, if you want it.

A 15 inch Victor Wheel is reported by Mr. Emerson to give 87 and 88 per cent.; yet a 20 inch tested in same flume gave only 75 per cent., and a 25 inch only 77 per cent. Do you suppose you would be likely to get any better wheel than these when you order one for your mill?

A 24 inch Wolf's Eureka, made at Allentown, Pa., was tested, and reported to give 84 per cent. This led mill-owners to order some of them. One man ordered a 48 inch wheel, and had it sent to be tested. *It gave 76 per cent.* The intended purchaser would not have it. Another man ordered a 54 inch; it was sent to be tested, and gave only 73 per cent. It was also rejected by its purchaser. These facts need no comment.

Take the American, Success, and all the wheels claiming such high results, and you will find the same thing to be true of them. A purchaser stands a very slim chance of getting a wheel, when at work in his mill, that will give him anything like the fancy results claimed by the builders.

We are not running down the wheels above referred to. They are good, and the leading flume wheels. But we do most emphatically state that no wheel built can be depended upon to give over 80 per cent., and that the "Perfection" and all other first-class wheels will not do any more than this, except, perhaps, with an occasional specially fit up wheel in a fancy testing flume test.

The "Perfection" Did It!

The information printed on the preceding two pages first appeared in our wheel book 6 years ago. This little article has become historical and is quoted every day by those in the water-wheel business. Sixteen years ago there was scarcely a water-wheel that guaranteed less than 85 per cent. efficiency. To-day, any water-wheel builder would be laughed out of a man's office who should offer to guarantee 85 to 90 per cent. None of the leading wheel-makers now claim to build a wheel that will give over 80 per cent. in efficiency. The "Perfection" has taught them to be honest.

The thousands of "Perfections" which are now in daily use, side by side with all the other wheels made, have settled forever and conclusively the fact that in the matter of efficiency it is without a superior, and that it can always be depended upon to yield 80 per cent. in useful effect. No man need worry his head on this score. The only points he has to decide are those of construction and price.

Needs no Penstock.

This is the great feature of the "Perfection" after its high efficiency and great economy in the use of water.

This is the feature that saves your money. Think of it and over it.

When you get any other wheel than the "Perfection," you must build a costly wooden penstock. It must be well built, too. It has not only to hold a great body of water, but it is the foundation for your wheel and all the machinery it carries. The penstock, in a short time, gets very leaky. If anything gets wrong with the wheel, it has to be crawled down into.

With the "Perfection," how different! It is always where you can see it. You can always get at it.

When these facts are considered, is it any wonder that we are having such great success with the "Perfection," selling more wheels than any other builder, and that it has won the reputation of being

THE GREATEST WHEEL IN THE WORLD?

Just a Word!

A style of wheel largely ordered is our Double Perfection, the best part gate wheel the world has ever seen.

It gives 80 per cent. at full gate.
80 per cent. at three-quarters gate.
80 per cent. at half gate.

And which we guarantee never to fall below 80 per cent.

As the Double Perfection is but an obvious development of the Standard "Perfection," we have thought best to fully describe the latter, and then there will be no trouble in every one fully understanding the Double wheel. The Double wheel is simply one Standard wheel placed upside-down on top of another.

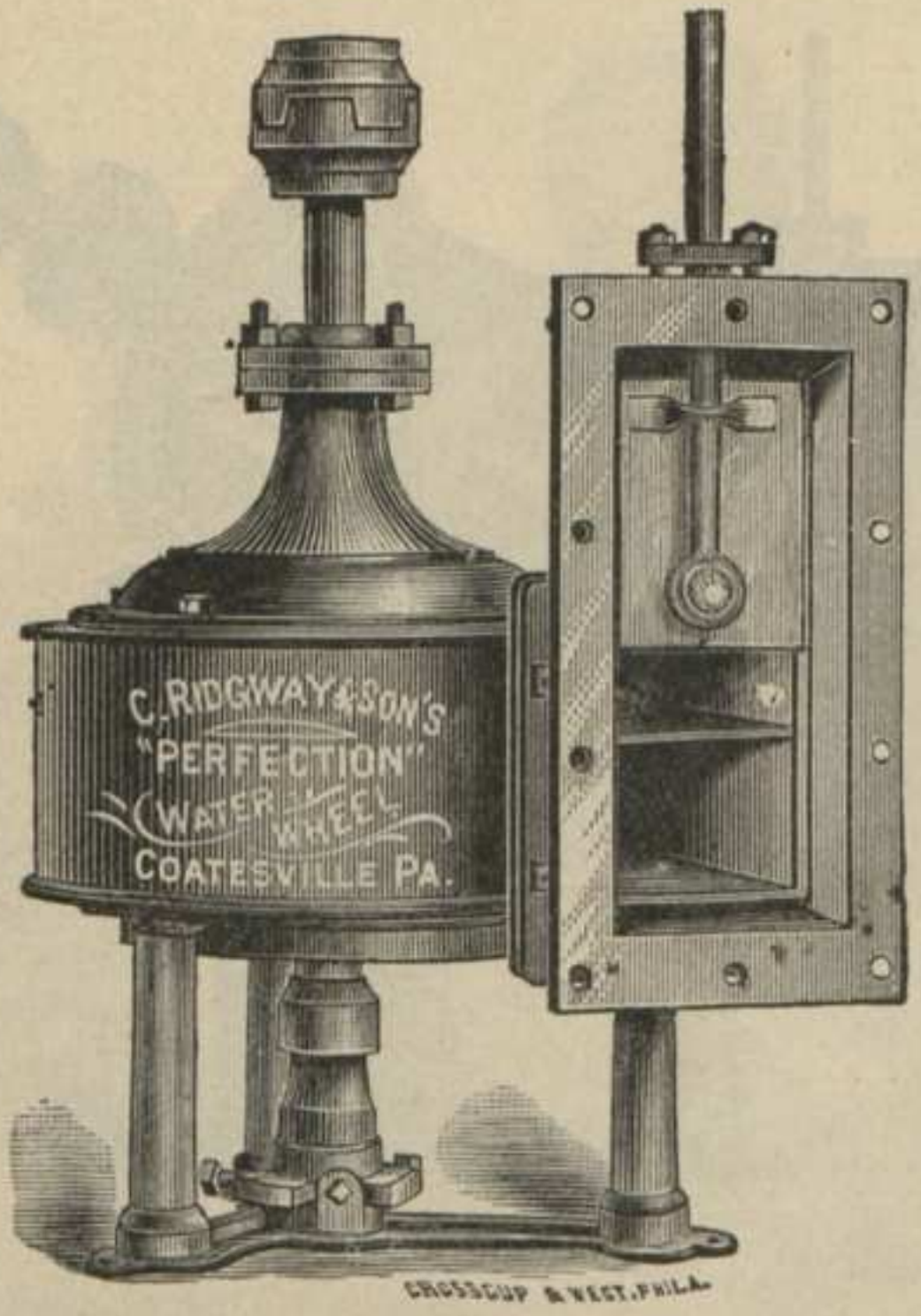
The Standard wheel has gained a high reputation all over the world as being the best full gate wheel ever produced. At part gate it is on a par with all other wheels. The reason why the Double wheel is such a good part gate wheel is because running at part gate is nothing more, in reality, than Standard wheels running at full gate. For ourselves we would rather have two Standard wheels than one Double, but the Double is considerably cheaper than the two Standards.

Our Illustrations.

Some of the cuts in this book show settings using Double wheels and some using Standard wheels. It will be evident to every intelligent man that either style wheel can be set in similar manner in every case except where wheel is shown set with a draft tube, in which cases, of course, only Standard wheels can be used. It will be understood that all settings can be modified to suit the requirements of special locations.

None of these cuts are fancy pictures, such as are found in most water-wheel books, but every one is taken from mills where wheels are in successful operation, and set in about the manner as shown, and we will be pleased to refer any to the mills if they should wish to go and see them.

We think this edition of the "Perfection" wheel book is the most profusely illustrated water-wheel circular ever issued by any wheel builder. We have crowded out the hundreds of testimonials formerly published, and have put in cuts of the mills instead, which latter we think will be appreciated by all sensible and practical mill-owners.



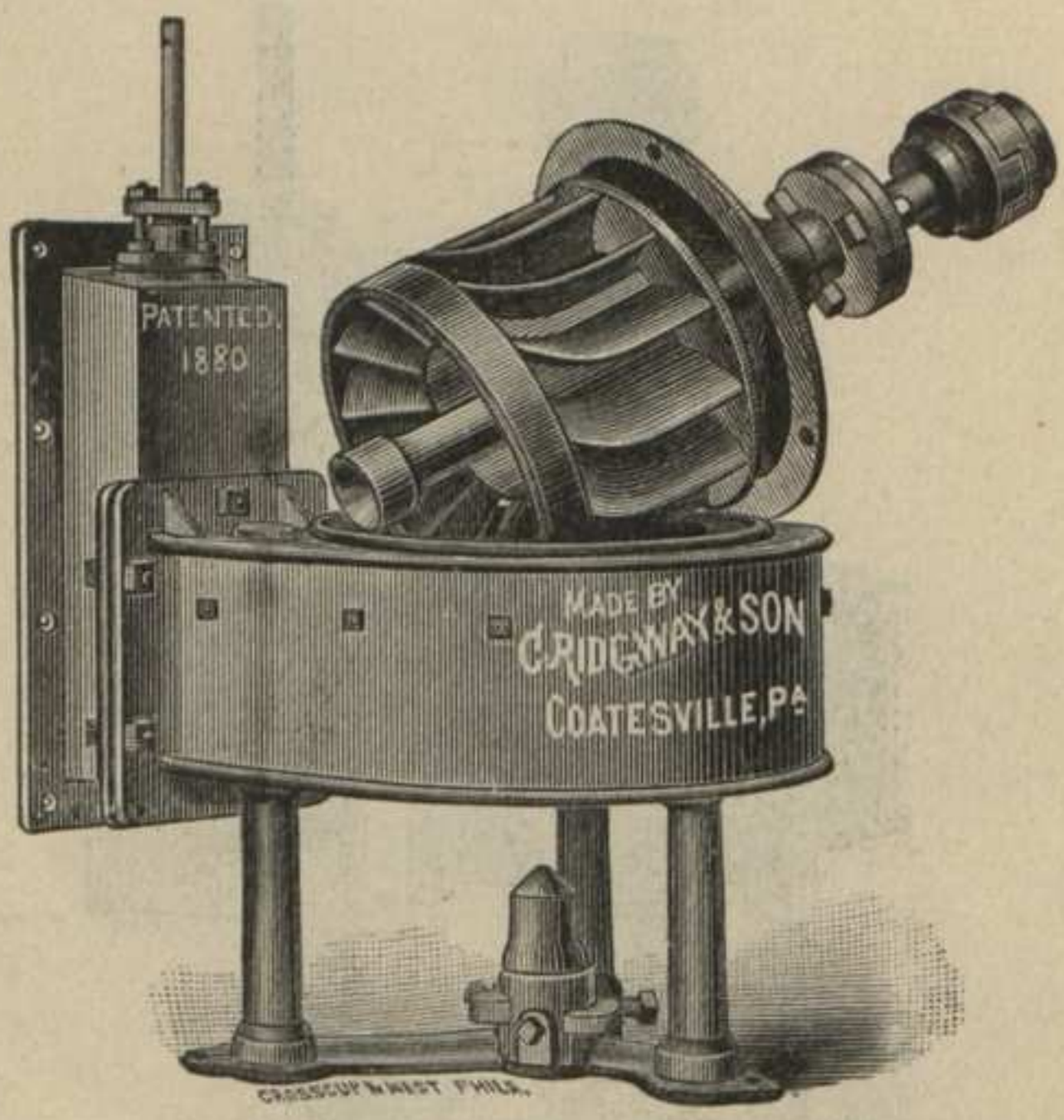
The King of Water Wheels.

The above cut shows our Standard Perfection Wheel looking into the gate box. We do not think a detailed explanation of it is necessary. The wheel as shown is ready to be bolted to a wood or iron spout and connect to upright shafting. It is such as is furnished for prices named in list on page 42.

As will be seen the wheel has but one opening, which is controlled by a sliding gate working on a planed seat, making a perfectly tight gate, and one that will always stay tight. The part gate partition is also shown. This partition confines the water when gate is but partly drawn, and makes the "Perfection" one of the best part gate wheels in the world.

It will be noticed that there are no rollers, cog gears, cams, or other trifling parts about this gate. There are only two pieces, the rod and plate. About the whole wheel **there is not even a single bolt under water.** Just think of it!

We make the gate box with round fiange when it is preferred. The wheel turns upon a wooden step at the bottom which is always under water, and at the upper end is carried by a long stuffing box in the dome filled with oiled hemp. The case is supported by columns secured to a heavy cast-iron spider.

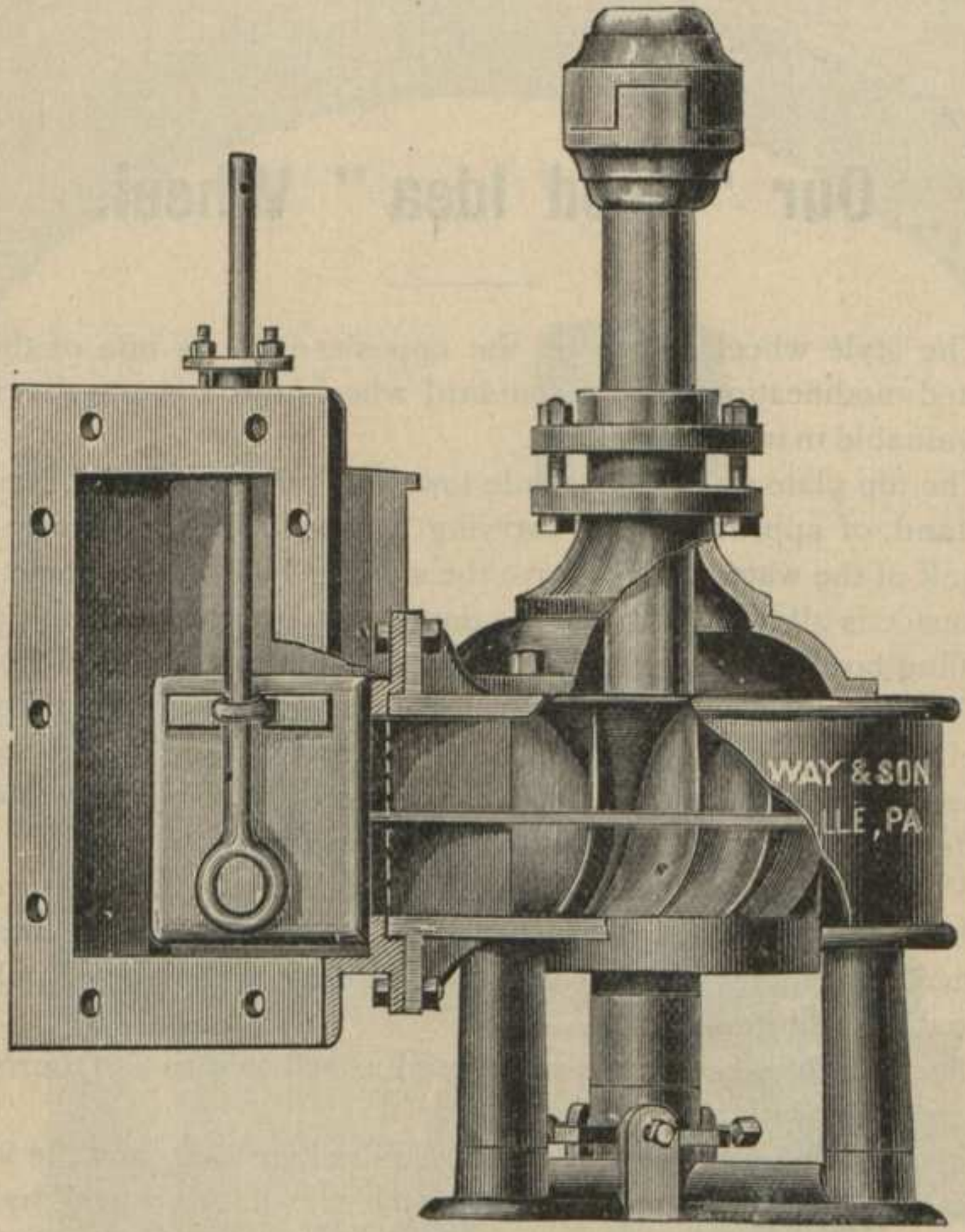


It is so Very Simple.

This cut is a back view of the wheel showing the runner or wheel proper lifted out. You can thus see how simple a machine it is. The curves of the buckets of the wheel proper are well shown. These curves are accurately calculated by mathematical formulæ, and are theoretically correct. The hub of the wheel is concave instead of straight as shown [an error of the engraver].

What we want to call attention to in this cut is the exceedingly easy and simple manner of getting at the wheel should occasion require. By simply unscrewing 4 bolts in the small wheels and 6 in the larger ones the dome and wheel can be lifted out of the case. There is no wet penstock to crawl down into. No having to draw off the water in forebay or race. The gate shuts down perfectly tight in the gate box and not a single drop leaks through, and any operations can be conducted upon the wheel that it may require without getting wet. You need not knock the coupling off to take out wheel, but lift out wheel and dome together.

Don't the simplicity of this little jewel take your eye! Is it any wonder that already over ten hundred mill owners have fallen desperately in love with it?



Sectional View of Wheel.

The above cut is a sectional view through the gate box and part of curb, and shows plainly the interior of the only part of our wheel that has any machinery whatever about it. It is so very simple that but little explanation is needed.

The gate is a plain flat plate sliding upon a seat which is made in the gate box. The gate and seat are both planed perfectly true, and are water tight. This gate has cast on it a large, round lug, over which the lower end of the gate rod is looped. The rod passes through a ring cast on gate also. It will be noticed that in this construction the gate can always be held up to the seat by the pressure of the water, independent of the rod, and as they wear can move toward the curb. The rod serves only to draw the gate up and down, and in this way the connection is a rigid one. The simplicity of the arrangement is very striking.

There is not a single Bolt or Screw Thread Under Water.

Our "Good Idea" Wheel.

The style wheel shown on the opposite page is one of the many patented modifications of our standard wheel, and it is one that is found very valuable in many situations.

The top plate or dome is made low, and on it is firmly secured an iron stand, of approved form, carrying a long bearing to firmly support the shaft of the water-wheel above the stuffing box on the dome. Sufficient space is allowed between the dome and bearing to permit packing of stuffing box when necessary. Above the bearing is placed the pulley.

This style of wheel may be used when the power can be taken off on a level with the wheel, which happens in many cases, and it saves the expense of upright shafting, clamp-boxes, and head-blocks, which latter are often hard to put up and find a place to carry them.

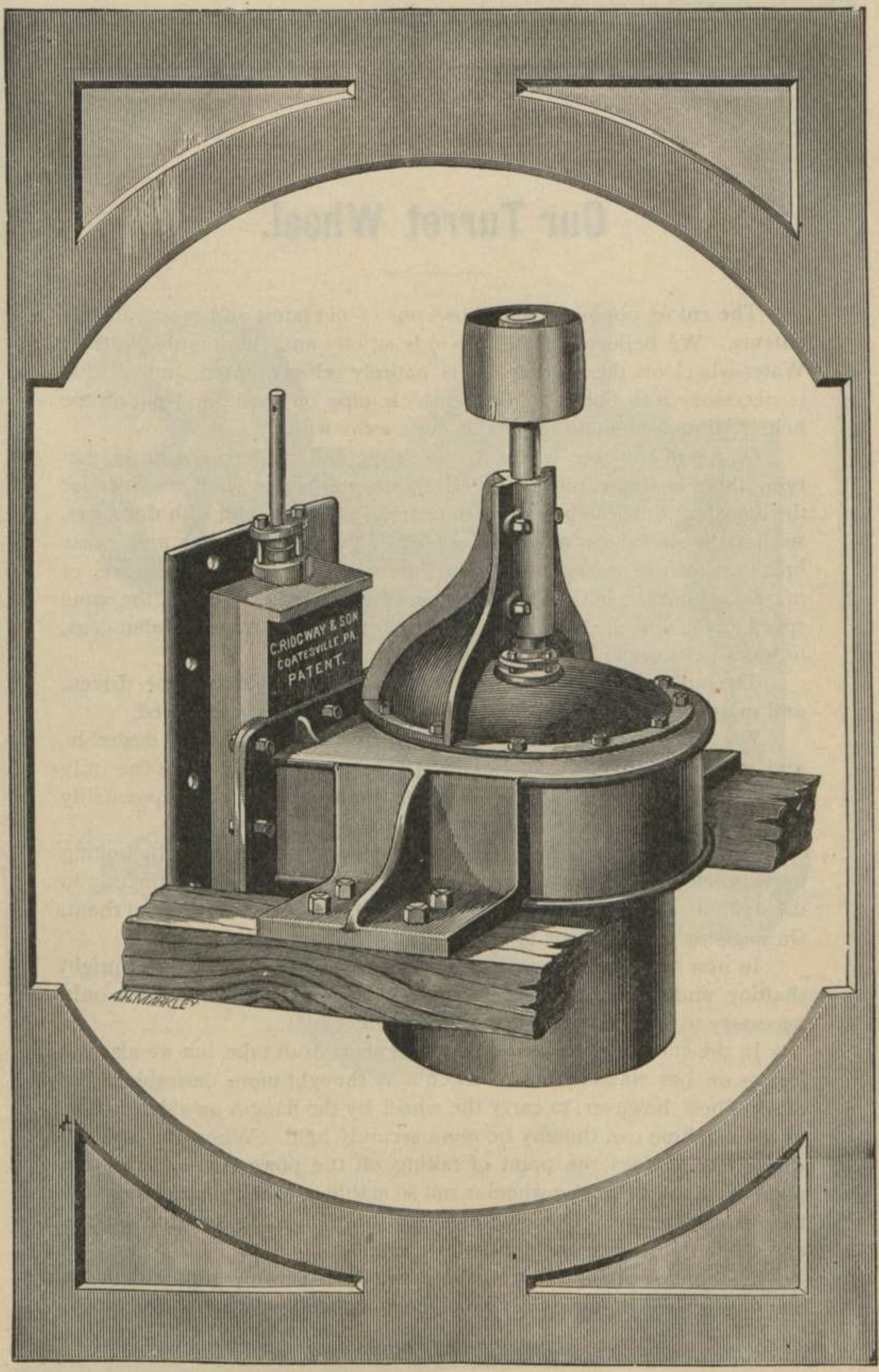
When it is desired to belt to line-shaft, it can be done by using quarter-twist belt, provided the line-shaft can be placed far enough away from the wheel, and there is not too great a difference in the size of pulleys on water-wheel and line-shaft.

This style of wheel can also be used to belt to a run of burrs or any other machine with upright shaft.

In cases where the size of wheel required is small, and the length of upright shafting very long, we advise the use of this wheel, by belting from the pulley to a pulley on the upright, which must be placed some distance from wheel-shaft, so as not to make too short a belt. In this way the heavy weight is taken off the water-wheel step, and the speed can easily and cheaply be geared down without having to use such large bevel gears, or a number of counter-shafts. Bevel gears five to one and six to one, and larger proportions, are objectionable, as they have to be made heavier than necessary to keep them true. In this way, with a fast-running small wheel, say, for example, a 10 inch wheel under 50 feet head, making eight hundred and forty-seven revolutions per minute, and desiring to gear on a line-shaft making one hundred revolutions, we can use a 12 inch pulley on the water-wheel belting to 50 inch pulley on the upright, and then take off the power from the upright by a pair of bevels two to one.

We make this style of wheel on legs as well as with the short-draft tube, as shown, just as best suits the circumstances of the purchaser.

The prices of these wheels are a little greater than those of the Standard, and can only be given when we know full particulars.


C. RIDGWAY & SON
COATESVILLE, PA.
PATENT.

Our Turret Wheel.

The cut on opposite page shows one of our latest and most valuable patents. We believe it to be the only strictly and thoroughly Portable Water-wheel on the market. It is entirely self-contained, and all that is necessary is to bolt it to the penstock, pipe or spout, and put on the belt. All upright shafting, etc., is done away with.

On top of the case is placed the strong and well secured turret, carrying three bearings, one on the upright water-wheel shaft, and two for the line-shaft. These bearings are generally all cast solid with the turret, so that the shafts can never get out of line with each other and cause breakage of the gears. The gears are made both the same size, or mitres, so that the horizontal shaft carrying the pulleys runs at the same speed as the wheel. The gears are one iron and the other wooden cogs, unless parties prefer iron and iron.

The pulleys are made to suit the speed of machinery to be driven, and may either be the same or different sizes, as may be required.

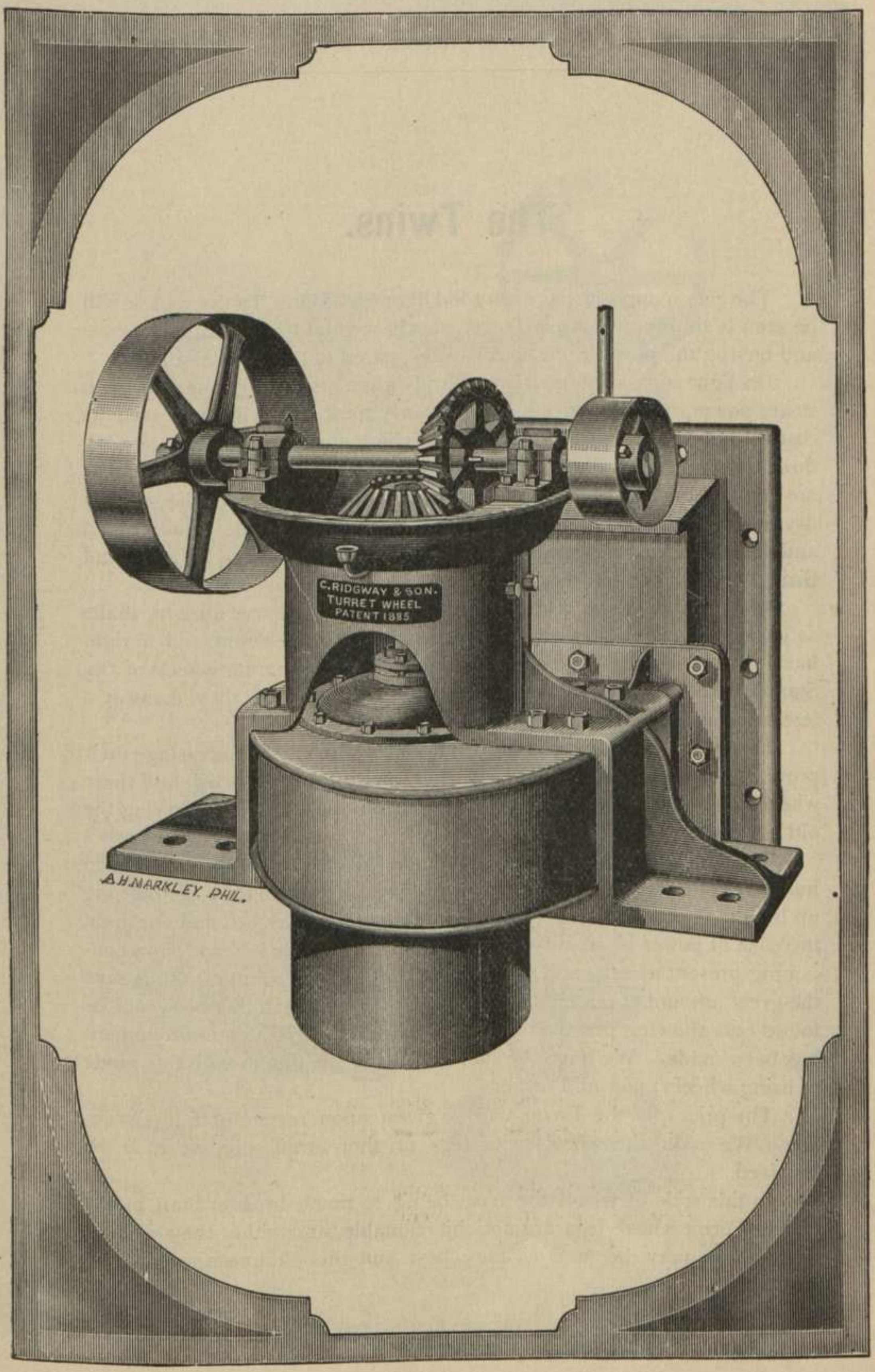
For many situations this style of wheel will be found very desirable, and will often save considerable expense and trouble. It is the only style that can be used in some locations on account of the impossibility of finding places to secure bearings.

For driving Electric Lights it will be found well adapted by bolting to penstock, already containing some other wheel and belting directly to the dynamo or to a line-shaft carrying pulleys to drive a number of them. On page 79 we show one of them driving two dynamos.

In new countries where there is no one competent to put up upright shafting and do the necessary work, it will prove valuable, as it is only necessary to set it level and conduct the water to it.

In the cut the wheel is shown with a short draft tube, but we also use legs as on our standard wheel when it is thought more desirable. We think it best, however, to carry the wheel by the flanges on side of case, as the machine can thereby be more securely held When this style of wheel sets on legs, the point of taking off the power is so high from point of support that the wheel is not so stable as when supported by the flanges on the side. The gate-box is also changed to suit iron pipe or any special construction of penstock or spout.

The prices of these turret wheels are considerably higher than the Standard wheels and can only be given when we know full particulars.


C. RIDGWAY & SON.
TURRET WHEEL
PATENT 1885
A.H.MARKLEY PHIL.

The Twins.

The cut on opposite page is a good likeness of OUR TWINS, and as will be seen is simply two of our Turret wheels secured to the same gate box, and having the power from both wheels geared to the same shaft.

On light and variable streams, and when used in connection with steam power, it is a most valuable arrangement and will soon save its cost in coal bills. It will give the same high percentage from one-half, three-quarters and full gate. Each wheel has its own gate, and the shafts are coupled together so that either wheel can be run without the other in dry times when the stream is light. This principle is more fully urged and shown, carried out under the heads **"How to Save Water and Gain Power,"** treated further on.

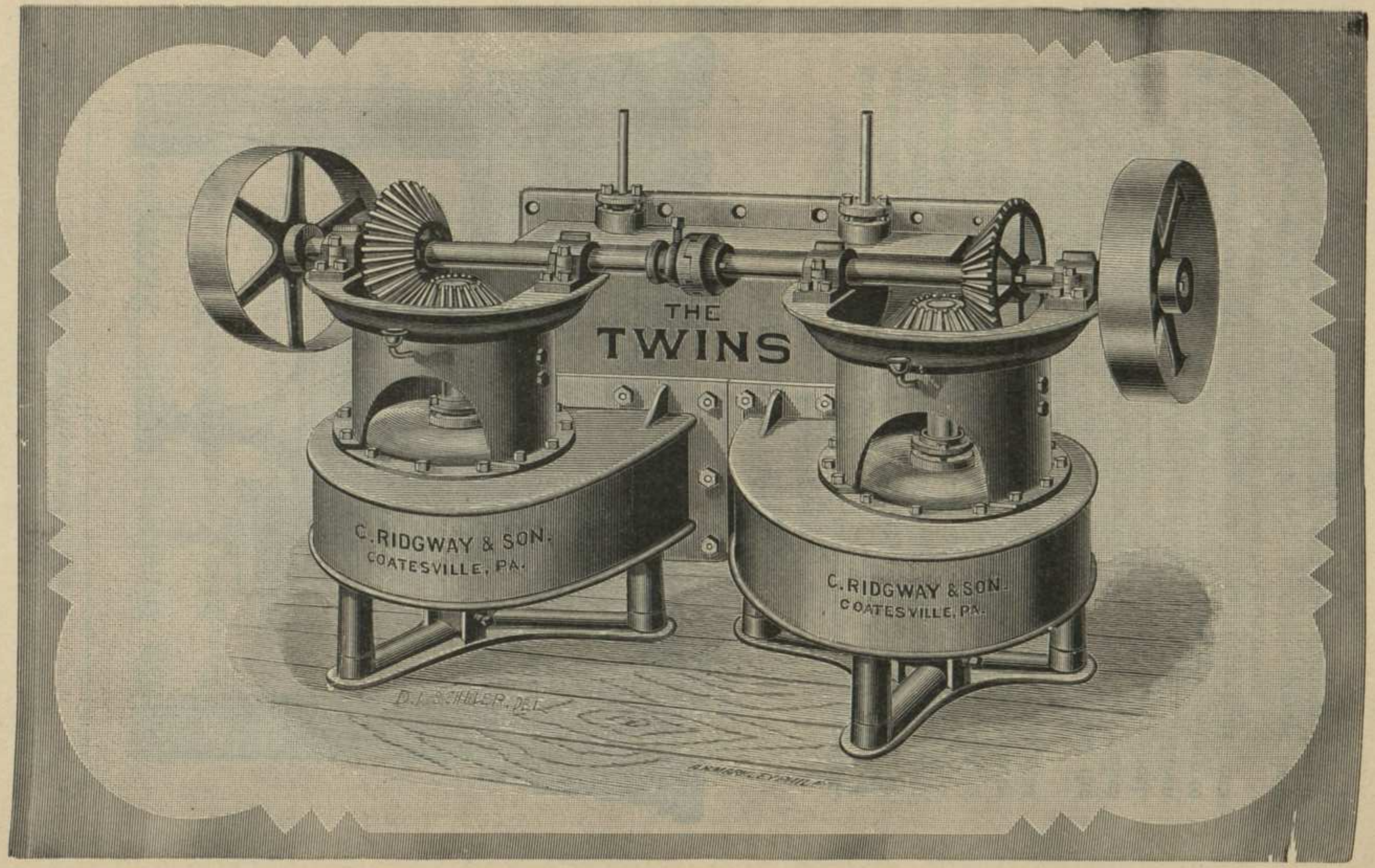
We can mount wheels together in this way and use upright shafts as in our regular style, when it is desired to use a left hand and a right hand wheel; although as a general thing the two separate wheels of the Standard are found to answer all requirements, and as they come at a less price are to be preferred.

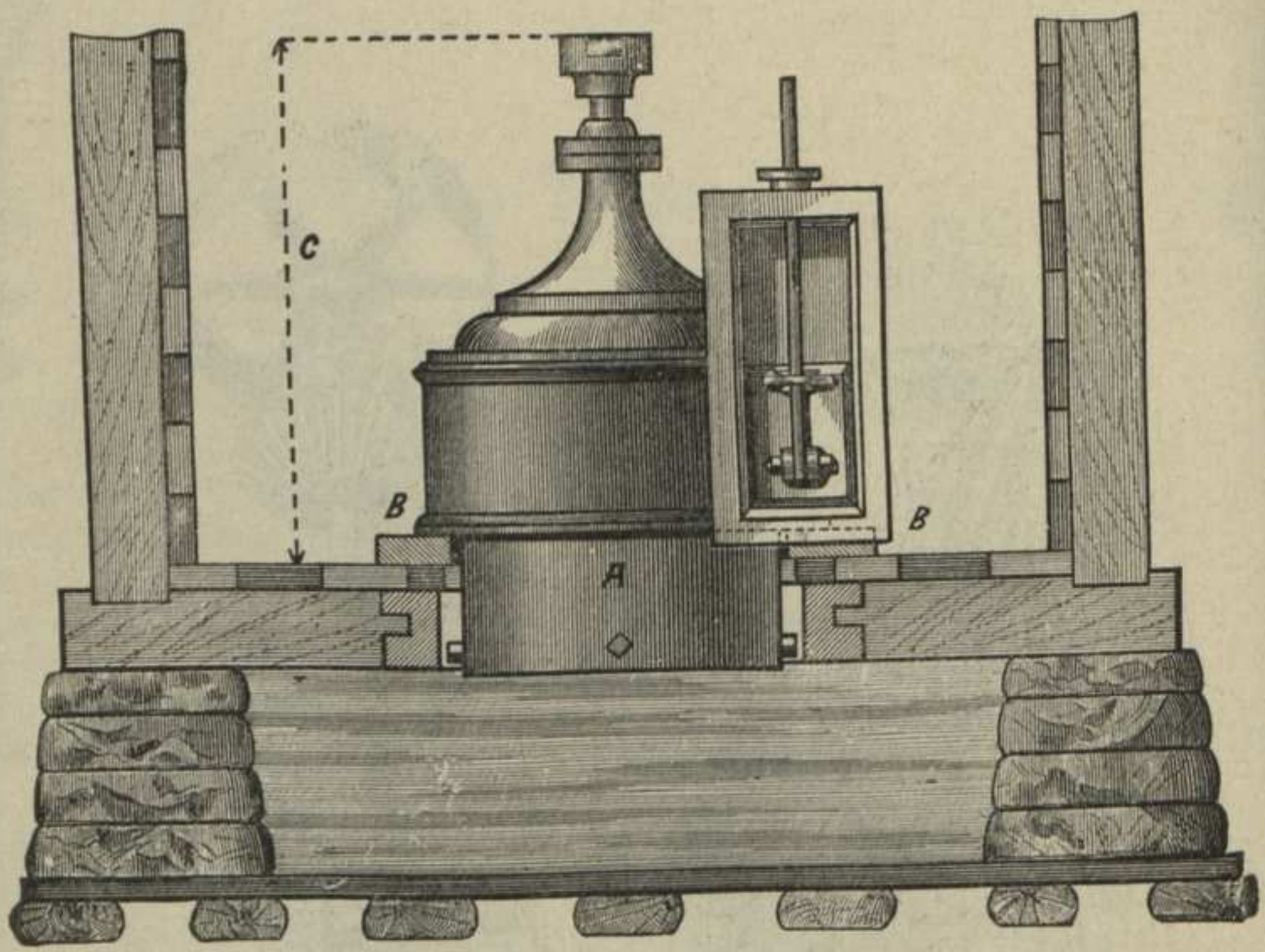
Large manufacturing establishments desirous of increasing their present power by adding auxiliary wheels at little expense, will find these wheels well adapted, as they can be bolted to penstock now carrying the old wheels.

Oftentimes for three or four months in the year many mills will have hundreds of horse power pouring over their dams, while they are burning up hundreds of tons of costly fuel. Great saving may be made or great increase of power be had by bolting OUR TWINS to the Penstock now containing present wheels, and use them in times of flush water, to thus save the great amount of power thrown away. Elsewhere in this book will be found cuts showing practical examples of mills where this improvement has been made. We have the honor of being the first to urge this mode of using wheels upon mill-owners.

The prices for the TWINS will be given upon receipt of full particulars. We make the wheels with legs or short draft tube as may be required.

In this style of wheel the base being so much broader than in the Single Turret wheel, legs are not objectionable, and either they or short draft tubes may be used as may best suit the circumstances of the situation.


THE
TWINS
C. RIDGWAY & SON.
COATESVILLE, PA.
C. RIDGWAY & SON.
COATESVILLE, PA.



Penstock Wheel.

Although the "Perfection" is intended to set outside of penstock, it may be set inside, as shown in above cut. For this purpose the legs are supplanted by a short draft tube. Oftentimes parties who wish to displace flume wheels, and whose penstocks are still good, can have "Perfection" wheels made in this way to take their place. When the distance **C** from floor to center of coupling and the bore of upper coupling is given us, we make our wheel to exactly suit. Around the hole the curbing **B** must be placed three to four inches high for wheel to set on, so as to keep flange of gate box from touching the floor.

If any one objects to the "Pefection" because it sets outside the penstock, it will be seen that it can be set inside just as well, and makes one of the best of flume-wheels, far superior to any other flume-wheel.

When the penstock wears out the same wheel can be set as shown in the many cuts in this circular. Any skeptical party who wants to replace his leaky and bothersome flume wheel with "Perfections" can in this way test them in his old penstock before he tears it out.

The price of wheels with short draft tube is a little greater than with legs, but is not so much as to deter any one from ordering them if preferred. We will quote prices on application.

The Wonderful Double "Perfection."

The Most Popular Water-Wheel Made.

Many Hundreds in Daily Use.

---

80 per cent. at full gate; 80 per cent. at three-quarters gate; 80 per cent. at half gate.

This is a strong claim, we know. It is true, however.

You do not have to pay for it until you put it in your mill and most thoroughly test it, and it does just as we say before your own eyes.

It excels all other wheels, as the hundreds who are using them abundantly testify. There is no wheel which will pay a mill-owner better to learn all about than this wheel. So many are in use that it is a simple matter to investigate.

In view of the fact that the wheel is so efficient at part gate, a purchaser is not likely to be disappointed if he is only sure to get a wheel large enough; in fact, a wise man will want a wheel that will drive him at three-quarters gate so he can have some reserve power.

DON'T YOU WANT?

Don't you want the very best water-wheel that can be had?

Don't you want as high percentage in low water as in flush water?

Don't you want the best wheel, if it costs no more than a poor one?

Don't you want a wheel with a perfect gate?

Don't you want a wheel that saves you the cost of a penstock?

Don't you want a wheel you can always see and get at?

Don't you want a wheel that never clogs with rubbish?

Don't you want a wheel that never wears out or gets out of order?

Don't you want a wheel that has no cog gears, no cams, no hinges, no cylinders, no sliding rings, no bolts or any other clap-trap down under water?

If the above is just what you do want, as we think it is, we ask that you give your attention to the double "Perfection," and see if it does not most fully and completely meet your idea of what a water-wheel should be.

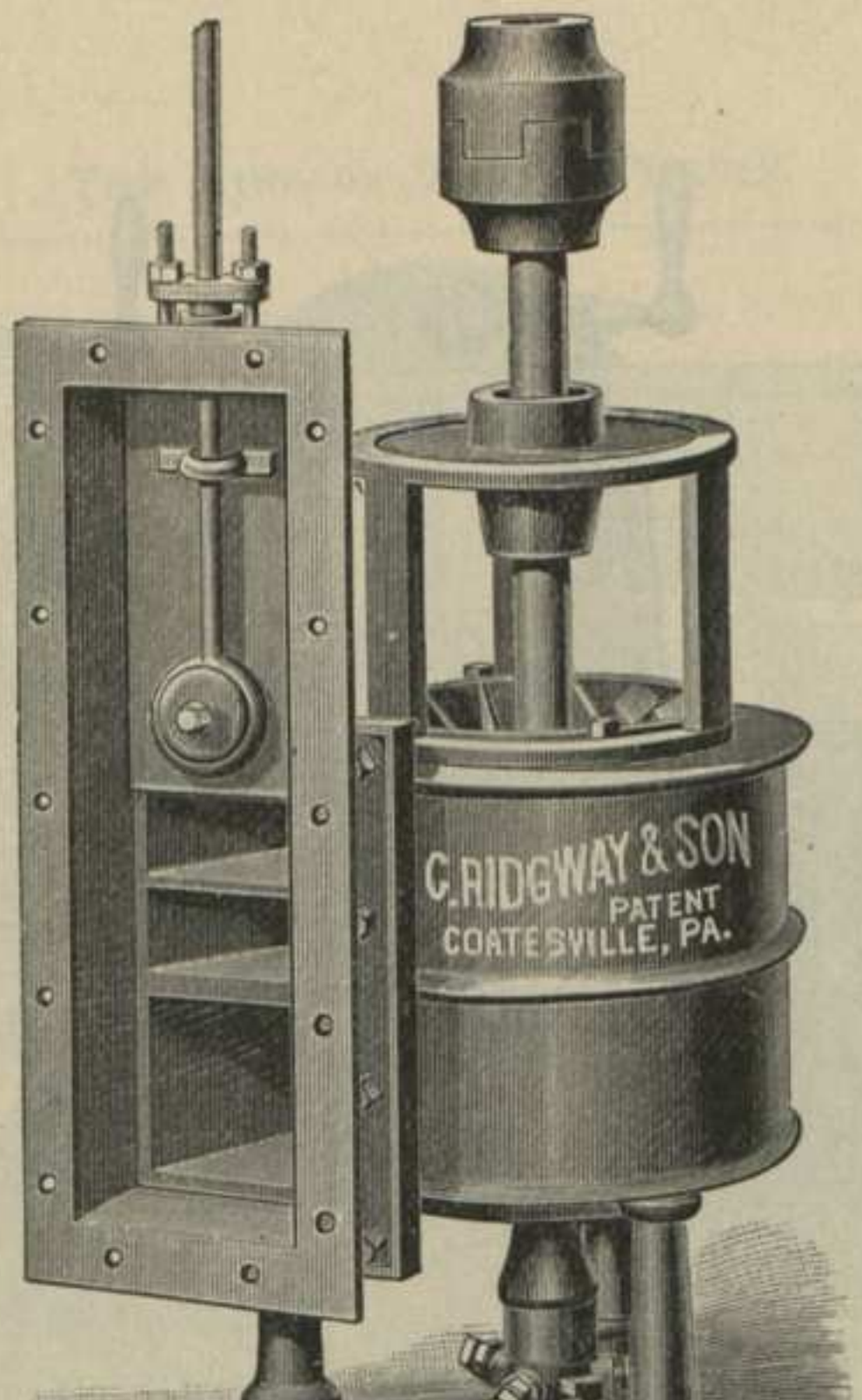
REMEMBER:—You don't pay for it until it does all we say, in your own mill, before your own eyes.

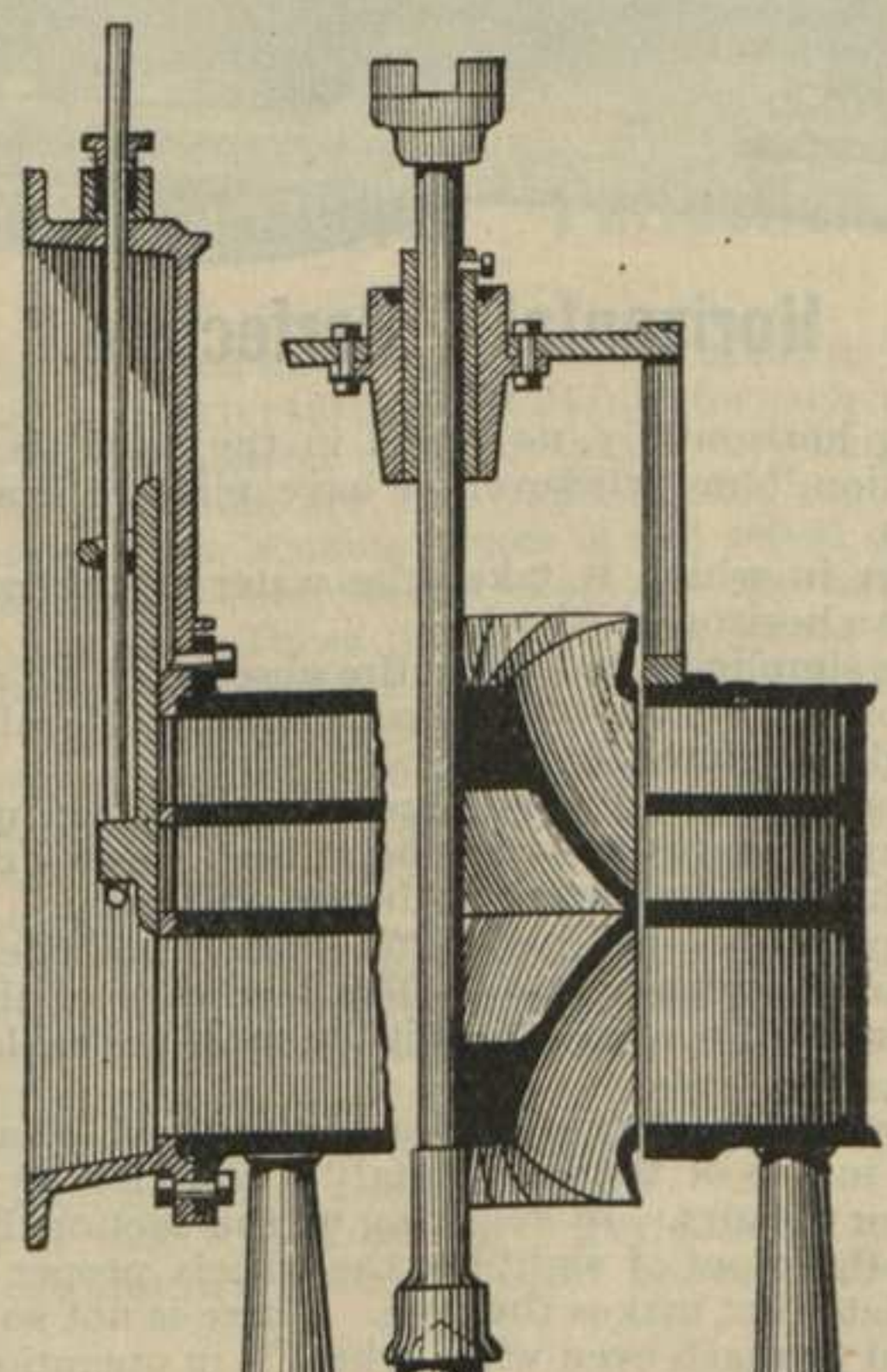
Description of the Double "Perfection."

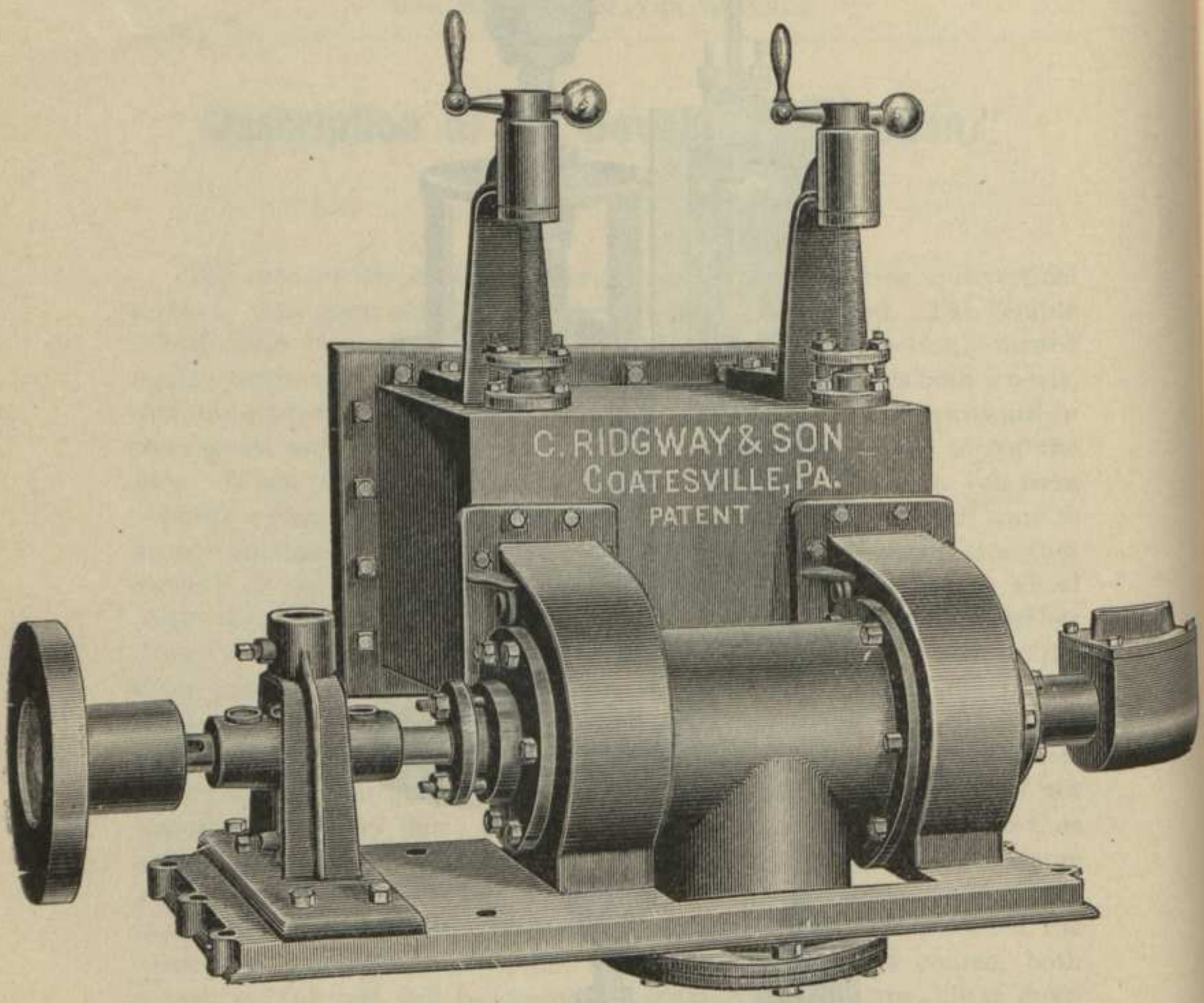
The cuts on the opposite page represent a perspective and vertical section. The great simplicity of the wheel will be noticed. The Double "Perfection" is nothing more than one Standard "Perfection" turned upside-down on top of another. One plain flat gate controls both wheels, and one shaft transmits the power. One wheel discharges downward in the regular way, while the other discharges upward over the top of the case. When the wheel is operated at half gate it is as though you were running a Standard "Perfection" at full gate, and hence at half gate is always obtained 80 to 85 per cent. In the upper case is a partition that extends all the way around the wheel. The buckets of the upper wheel begin their backward curve at this partition. When the gate is further drawn to this partition, making three-quarters gate, the water in the upper case is kept confined or packed in a solid column and enters next to *the inverted concave hub of the wheel.* This is the same thing as a regular wheel at full gate in which the discharge openings of the buckets is larger than the inlet opening of the case. This, however, does not appear to have any but a beneficial effect upon a wheel of this sort, as one of this style of wheels, tested at Holyoke, in which the discharge area of buckets was 218 sq. in., and area of mouth of case only 162 sq. in., gave 81.64 per cent. Hence at three-quarters gate is obtained the same high percentage as at half gate. At full gate, of course, both wheels are full and full percentage is obtained and we are able to guarantee every customer 80 per cent. of the efficiency of his water down to half gate.

The question will naturally be raised whether the top wheel will be as efficient as the bottom wheel. No, not quite, but the difference is so slight that it cannot be noticed. In the top wheel there is a slight loss of head equal to half the depth of the top half of the case. This varies from 2 in. in the smallest wheel to 10 in. in the largest, and is so trifling as to be inappreciable save in very large wheels under low heads. As water is plenty when wheel is run at full gate such a loss of head, even if ten times as much, would cause no trouble. When water is scarce and economy is imperative, then is the time the Double "Perfection" economizes it. This is in striking contrast to all other wheels, which only do their best at full gate when the stream is full, and waste the water when it is scarcest and most valuable.

In operation the water from the top wheel does not fly all over the pit as much as might be supposed. It merely rises from the wheel to clear the case, and when the wheel is properly set all that is seen is but a bubbling in the tail-water as it moves to get away from the wheel.


C. RIDGWAY & SON
PATENT
COATESVILLE, PA.





Horizontal "Perfection."

For setting horizontally, no wheel in the world is so well adapted as the "Perfection," and wherever we have placed them they have been a grand success.

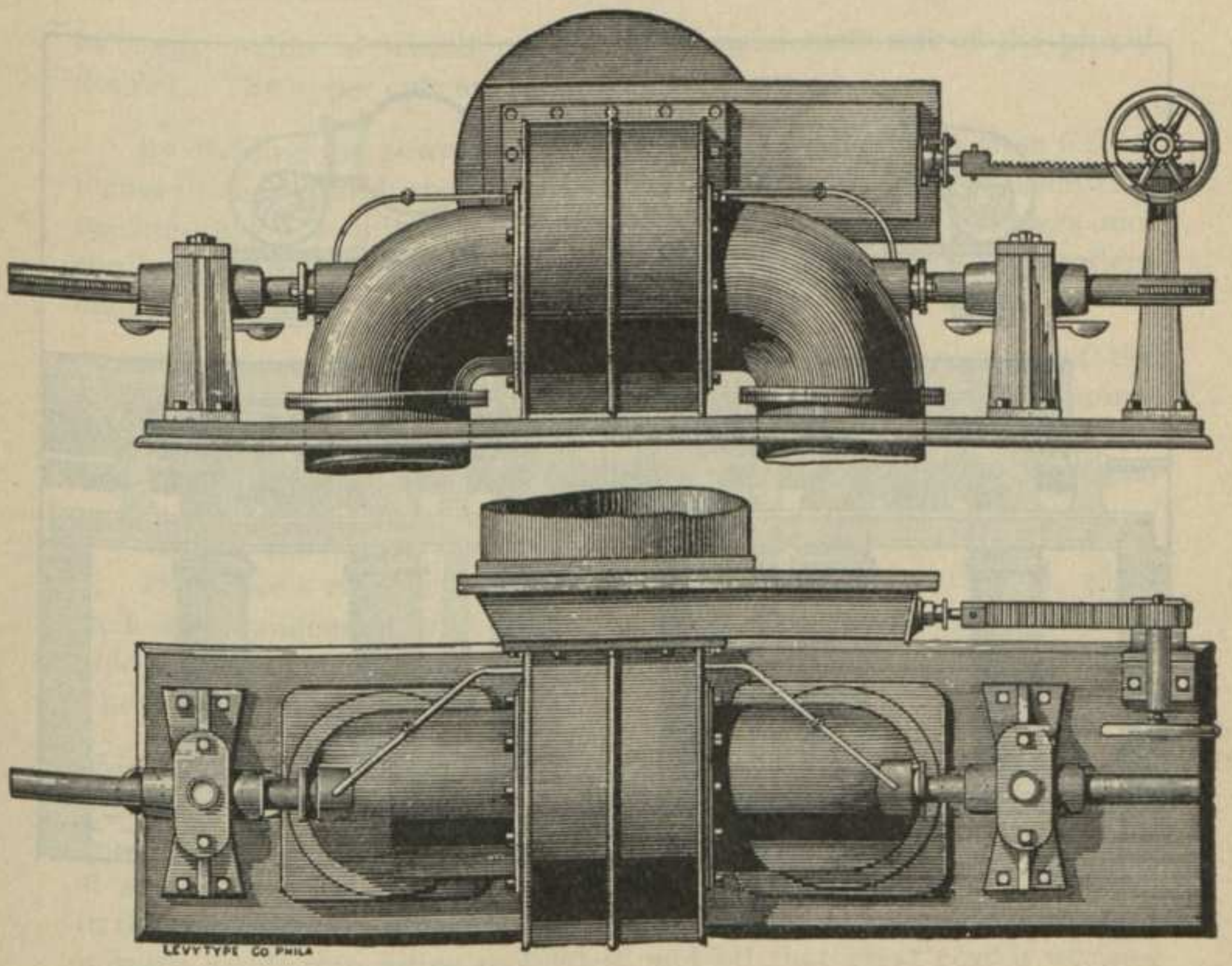
The manner in which it takes the water is the most natural and obvious one for a horizontal wheel.

Its extreme simplicity and the entire absence of all machinery under water and out of sight cannot fail to recommend it to all discriminating mill-owners and superintendents.

The fact that horizontal wheels are generally used upon high heads and under heavy pressures and running at high speed makes the feature of simplicity almost as important as that of efficiency.

The high price of other horizontal wheels has been an obstacle to their introduction in many plants. The low price of the "Perfection" Horizontal permits all who may find it the most desirable form for their power to use it.

All those who have the care of a power plant of a mill will appreciate the great merits of the Horizontal "Perfection." There are never any stoppages or repairs. By referring to the sectional views it will be seen there is nothing out of sight but the wheels proper or runners, and the plain flat plate that makes the gate. There is not so little as even a bolt out of sight or reach even when wheel is in operation.



The Horizontal "Perfection."

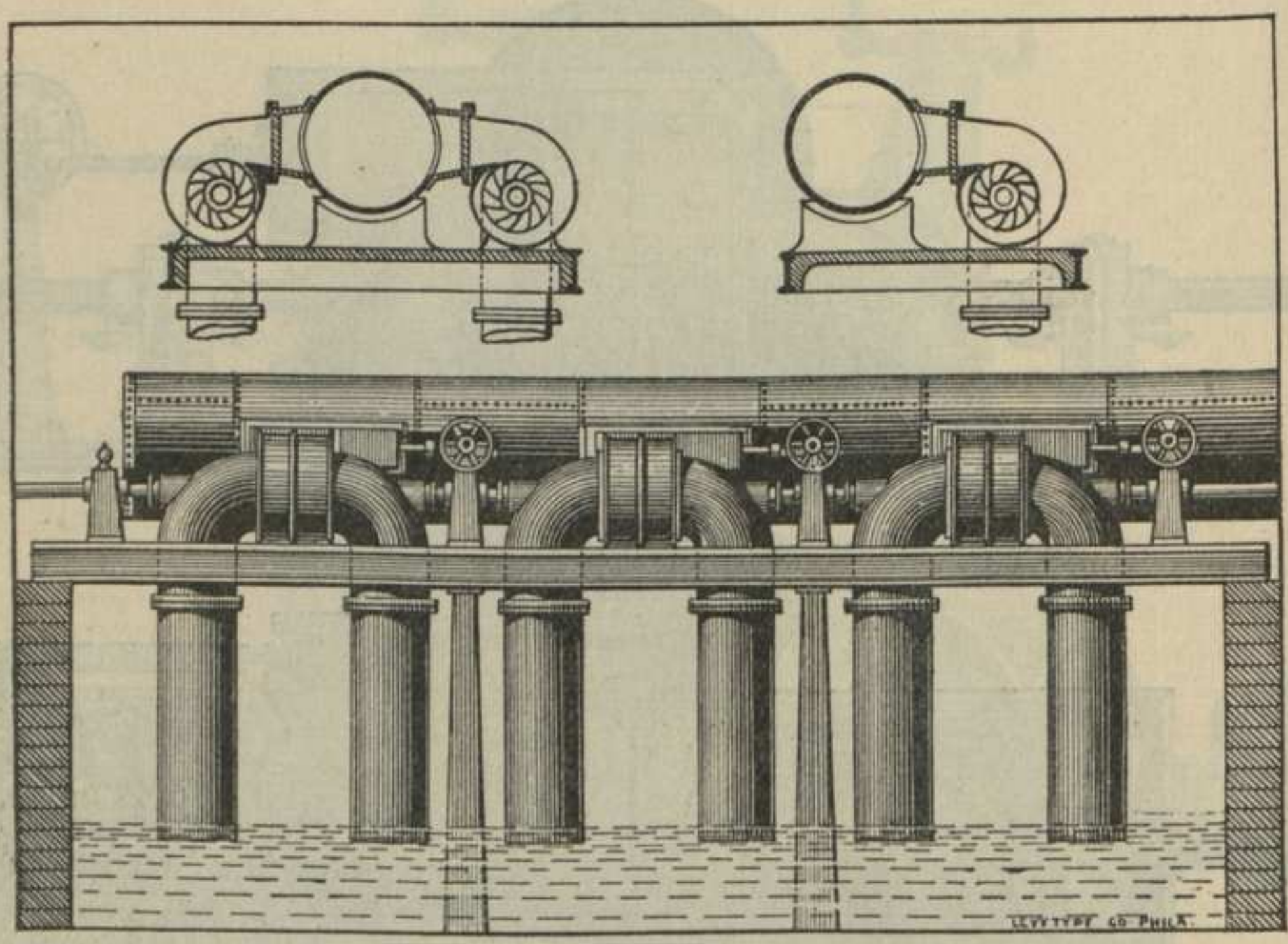
The above cut is a plan and elevation of the usual style of Horizontal "Perfection," having quarter turn and draft tube for each half of the wheel.

The bearings in the quarter turns are made very long, and are fitted with bronze bushings, which are easily and quickly renewed when worn out. The packing in the stuffing boxes is not relied upon to keep the draft tubes air-tight, but compression chambers are formed, into which the pipes shown are led. These pipes keep the joints filled with water when wheel is running, so there can be no leakage of air into the tubes, even should the fibrous packing be neglected entirely. All the flanges are similarly protected, so that the wheel is absolutely air-tight. This is a matter of first importance, as horizontal wheels are always set above tail-water, and any air leaking into the draft tube would cause a loss of head and, consequently, power.

The gate is drawn by a single hand-wheel within easy reach. A rack and pinion or screw is used depending upon size of wheel, the head it is under and the class of machinery driven.

For saw-mill and similar work where it is necessary to open and close gate frequently from a distance, we furnish a special quick acting gate that can be operated by a cord from any point.

A governor is rarely used on the "Perfection," even for electric lighting. It is the steadiest running wheel known, and practically self-governing.



Tandem Horizontal "Perfection."

Other water-wheels, with their more or less complicated parts and leaky gates, give bother and trouble enough and waste water enough when only one is used, that most mill-owners would shrink from the idea of using a string of them as here shown with the "Perfection." Indeed, a man would be very ill-advised to set a lot of flume wheels this way. All flume wheels are so faulty and bothersome that it would be simply multiplying trouble, and as the wheels would require separate outer cases, the cost would be enormous.

The "Perfection," however, is so extremely simple, and is so reasonable in price, that for it this style of mounting is a most elegant one, and one very moderate in cost.

A boiler plate cylinder (worn-out boilers make elegant ones) is laid horizontally, and a line of "Perfections" is bolted to the side of it. They all have a common shaft, which may be in one piece or coupled together between each wheel. The wheels and pipe are shown carried upon wrought-iron I-beams, but wood stringers or stone or brick arches could

be used. A line of wheels can be bolted upon each side of the pipe if desired. The upper cuts are sectional end views.

By dividing the power in this way among small wheels from 6 to 42 inches diameter, high speed can be obtained and only light transmitting machinery be required. For driving Dynamos, Pulp Grinders and similar machinery, by direct connection, this arrangement is an excellent one.

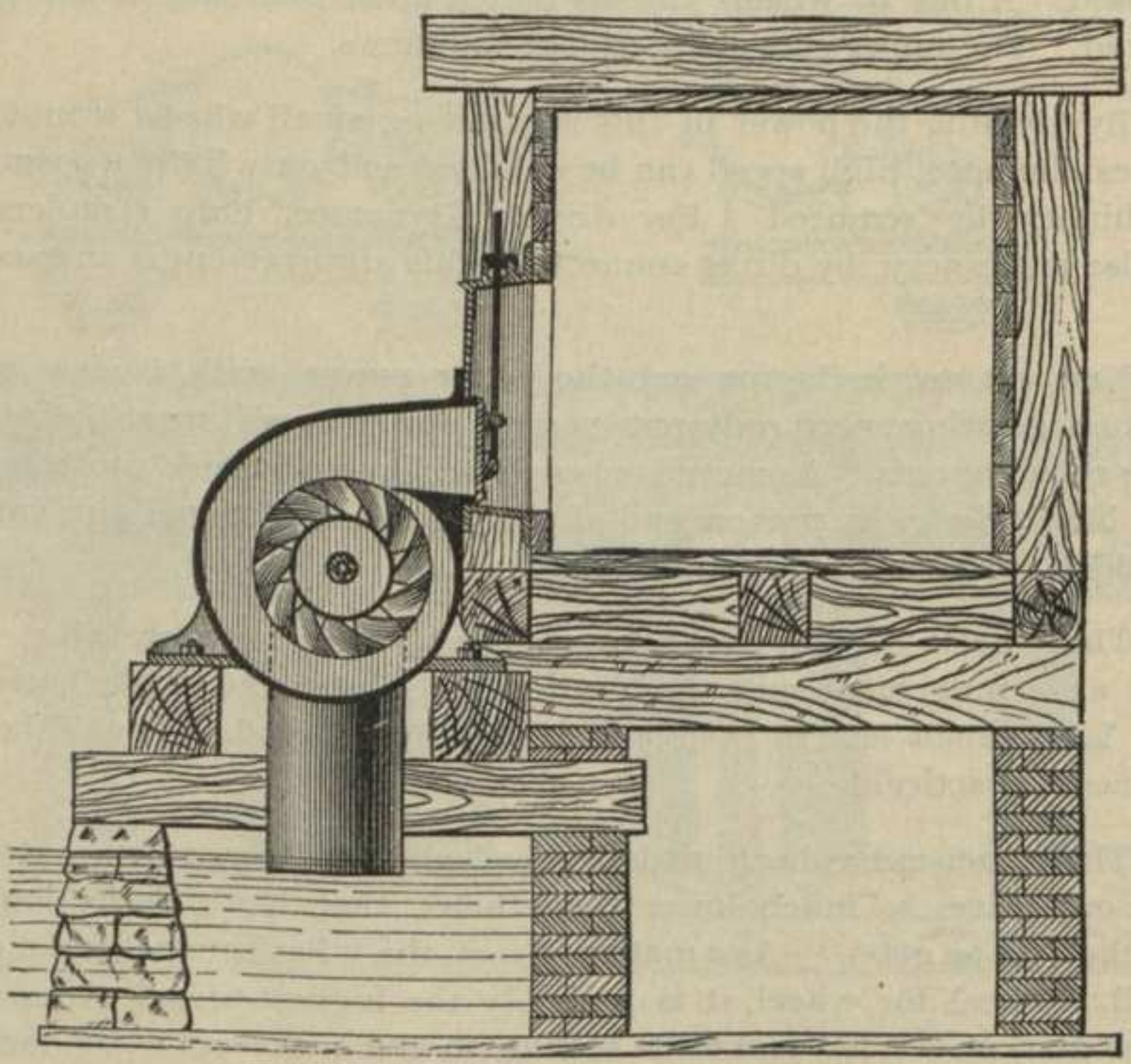
New plants, in laying out the water power, with a view of the business growing, need only put in such power as will meet their immediate requirements. As more is needed, additional wheels can be added. If a blank flange is put on end of the pipe the additional pipe can also be added with the additional wheels.

The wheels can also each be supplied with a separate pipe, when such an arrangement suits the location best, but as the single horizontal pipe is so much less in cost, and is equally as good, it should be used whenever practicable.

The criticism has been made by rival wheel builders when confronted with our prices so much lower than theirs, that the "'Perfection' was too cheap to be good." As a matter of fact, the "Perfection" is not cheap at all. Wheel for wheel, it is probably the highest-priced water-wheel in the market. What makes its setting so much cheaper is the fact that it needs no big iron casing to hold it, and all that great cost is at once saved. *The "Perfection" is simply a better disposal of cast iron to produce a given result.*

If every mill-owner who needed a water-wheel would take the trouble to go and visit mills where "Perfections" are in operation, and note their performance, we would sell every one of them the "Perfection." They would have no other kind. While the "Perfection" is so obviously the proper plan for setting wheels horizontally, yet it takes time to educate some mill-owners up to even their best interests. (How long did they stick to the expensive "Boyden" wheel?) It is with many men an easy thing for a good talking agent of a rival wheel to persuade them that so simple a wheel as the "Perfection" cannot be as good as the many-gated and complicated affairs known as the modern turbines—wheels, which if set up in the dry of the mill, would be hard to keep in trim, not to speak of sticking them out of sight and reach, under water, to rust and wear.

Take Notice.—Setting wheels in "tandem," in the manner shown in this cut, is secured to us by patents. We caution all mill-owners not to purchase and so set wheels from others, as we will hold them responsible. Messrs. Stilwell & Bierce Company, Dayton, Ohio, have purchased from us the right to so mount "Victor" wheels.



Horizontal "Perfection" and Wood Penstock.

The above cut is a section showing a Horizontal "Perfection" and wood penstock or trunk, and clearly shows how cheaply the wheel may be set.

The section through the wheel shows its extreme simplicity and the entire absence of anything that can by any possibility get out of order or give trouble.

If any one should desire to test the "Perfection" in comparison with a wheel now already in the mill in a wood penstock, this cut indicates how easily it may be done. We sell every wheel we make, whether vertical or horizontal, upon the condition that it must equal any other water-wheel, and many cuts are given in this book to show people how easily they may test the "Perfection" and see if it does what we say it will.

Any one contemplating the putting in of a horizontal wheel should give the "Perfection" careful consideration. Go to mills where they are in operation and see for yourself whether or not what we claim is carried out in practice. If you will do this we are as sure of your order as though we already had it.

Double "Perfection" and the Overshot.

"I never saw an iron wheel that could equal an overshot on a light stream. So say dozens of experienced men. They tell the truth. Never before the Double "Perfection" has there been a turbine that could equal an overshot, because never before has there been a turbine that would give as high a per cent. at half as at full gate, and which has an equally tight and simple gate.

In an overshot the water acts directly by its weight, and the friction being almost constant, the wheel gives the higher percentage the less water there is in the buckets. That is, if water is abundant, the buckets can all be filled level full. Of course, in such a case water is spilled and wasted; but who cares for that when it is pouring over the dam anyhow? When the supply falls off, the buckets are only partly filled, and a good percentage is obtained at the very time economy is most needed. There are lots of turbines which, when run with gates wide open, will give a higher percentage than any overshot using the same quantity of water. But when water gets scarce and the turbine's gates are partly closed, what happens? The percentage of the turbine falls like a falling star, and water is wasted at the very time you want the most out of it. What happens when you begin to close the overshot's gate? The buckets having less water in them, it is carried further down before spilling, and the percentage, if it changes at all, rises, and you get the best results when best results are most wanted. Where a good overshot gives from 70 to 80 per cent. at half gate, the best turbines give from 30 to 50 per cent. The man with overshot in low water can do a tolerably good business, while the man with the turbine must shut down in disgust and sigh for his overshot back again.

Now examine the Double "Perfection." Give it and the overshot the same water, and it will beat the overshot, for it utilizes all the head, has no heavy gearing, and don't spill or waste water. Cut to three-quarters, and the Double "Perfection" still beats; for it does as well at three-quarters as at full. Drop to half water, and the overshot is still beaten; for, if anything, the "Perfection" does better than at full. In other words, the Double "Perfection" works water just like the overshot. This is the reason why every man who gets a Double "Perfection" is delighted with it, and why he can run when his neighbors are shut down for want of water.

We hardly deem it necessary to point out the similarity in tight gates. Other wheels, with their leaky gates, soon sicken mill-owners on light streams. Under high falls small cracks leak floods of water. The "Perfection" gate is tight, and stays so. The higher the head and the more it is used, the tighter it gets. The overshot wheel, being at top of fall, under no pressure, is always tight. So, in tight gates, the "Perfection" and overshot are alike, as well as in the matchless way they work and economize water.

The Horizontal "Perfection."

Driving Large Factory.

The cut on the opposite page represents a Double Horizontal "Perfection," recently placed in a large factory in the East. The engraving tells its own story so well that extended description is unnecessary. The gates are arranged so that wheel may be stopped from any floor of the mill in case of accident. The gate rod is extended up through every story, with a hand wheel on each floor.

The situation and circumstances of the factory where this wheel is placed are such as would test the efficiency of any horizontal wheel.

The stream, which in former times was a good one, has latterly become deficient, owing to the cutting off the timber at the head waters. At times the water is very limited, and as the factory has no steam plant, the water must be used with the greatest possible economy or the factory close down and throw hundreds out of employment. The turbine which the "Perfection" displaced was one of the best flume wheels that has probably ever been produced, one that has been repeatedly subjected to scientific tests and showing the highest efficiency. It was set in the best possible manner, and in an iron quarter-turn case. It was set in tail-water under 32 feet head. In fact, this was one of those cases that try the nerves of the wheel builder. It is an easy thing to beat a slab-sided, worn-out overshot or a fourth-class turbine, but to displace the high-class wheels one must know what he is doing and have an efficient turbine.

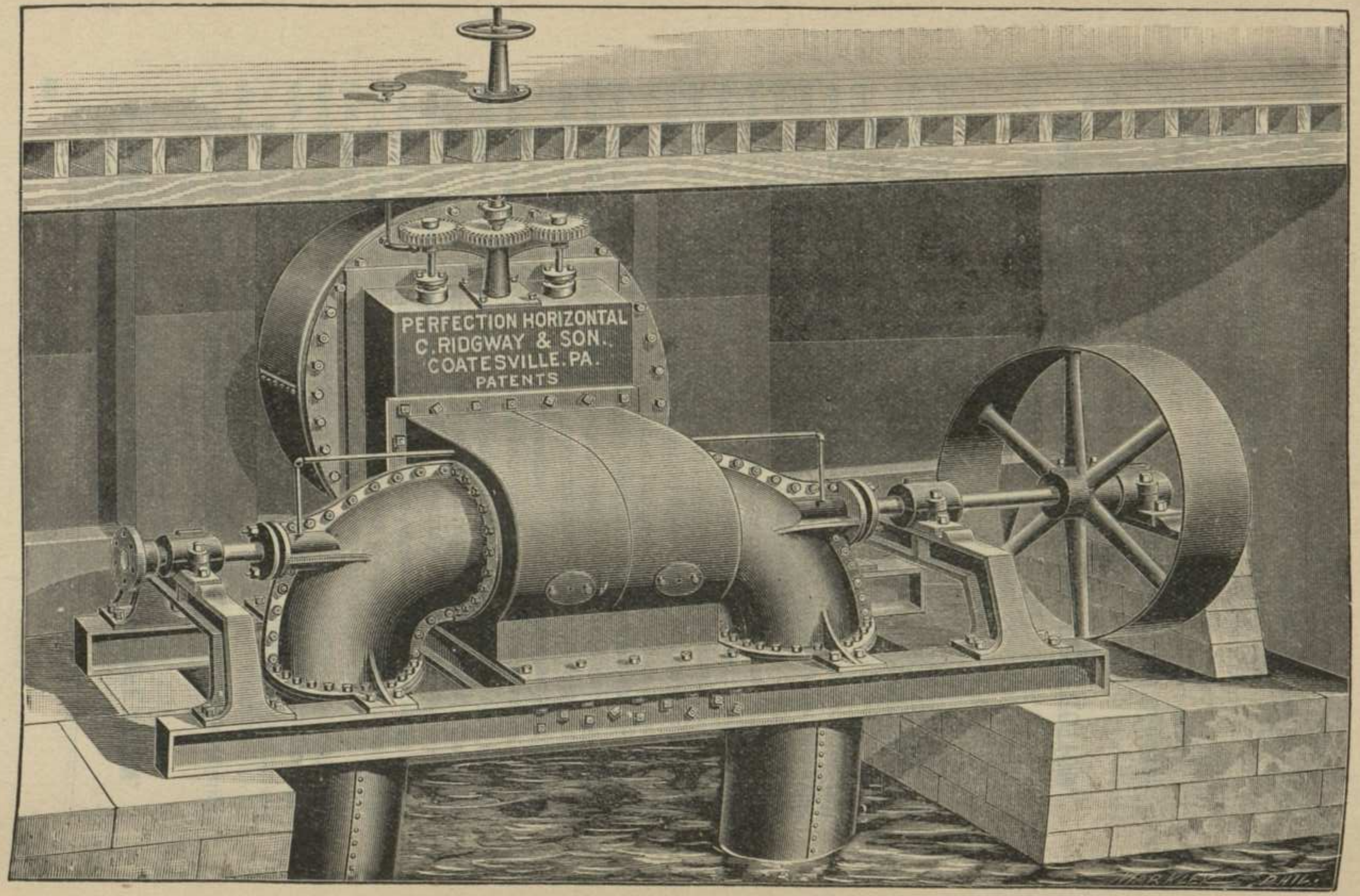
To have set any other than the most highly efficient horizontal wheel in this mill under the circumstances would have been disastrous. We furnished the "Perfection" upon the condition it was not to be paid for until thoroughly tried and its excellence proven. This it demonstrated as soon as started, and it was at once paid for, and the company express the greatest satisfaction with its performance. They have since built another factory, and have gotten three more wheels same as this.

While many other horizontal wheels are adapted only to rivers where water is so plentiful that the waste of a few hundred cubic feet per minute is not missed, any one can unhesitatingly place the horizontal "Perfection" upon the lightest streams. It will economize water just as elegantly as the Vertical "Perfection," and is sold with the same guarantee.

The only difference between the two types is that of cost, the horizontal wheel being much more expensive.

While we make horizontal wheels, both single and double, we in all cases recommend the double as being the best practice.

These wheels shown in this cut are within fifty miles of New York City, and we will be pleased to furnish name and address to any one who would like to go and see them or write to the parties using them.


PERFECTION HORIZONTAL
C. RIDGWAY & SON.
COATESVILLE. PA.
PATENTS

A FEW ADVANTAGES OF THE DOUBLE PERFECTION.

1. You have double the power. A wheel of small diameter at high speed requiring only light shafting, etc.

2. You have really two separate wheels, but instead of having them side by side with two upright shafts, two sets of boxes, gears or pulleys, you have one on top of the other and one shaft and one set of transmitting machinery answers.

3. If your stream is variable, you select a wheel your stream at its lowest fills at half gate. When water gets better draw to three-quarters, and when abundant draw to full.

4. If your business is of a kind likely to increase, you select a wheel that will drive you now at half or three-quarters gate. You thus have a reserve that will in the future save you hundreds of dollars expense.

5. The speed is same at all gateages. You put in wheel big enough to drive (say) two or more burrs, rolls, rag engines, etc., at full gate when water is plenty. When water is scarce drop to half gate and drive one-half the machinery at the same high percentage and same speed.

6. It is the only water wheel ever produced that works water like an overshot. An overshot (approximately) gives same percentage whether buckets are half filled or fully filled; all other turbines are absolutely worthless when using half the water they use at full gate; that is why people who throw out their overshots wish they had them back. Like the overshot, the Double "Perfection" gives same percentage when buckets are half filled as when full, and this is why we equal the best overshot ever built. In fact, it beats any overshot, because it uses the full fall and does away with heavy gearing.

7. It does away with penstock, has a perfect gate, is always under eye, is always get-at-able, don't wear out, don't clog with rubbish. In fact, to state all its advantages would fill a book.

WHAT WE CLAIM FOR THE DOUBLE PERFECTION.

1. It never gives less than 80 per cent. of the power of the water at full, three-quarters and half gate. It sometimes gives 85 per cent.

2. Its gate never leaks, even after twenty-five years' use.

3. It is so simple it never gets out of order or wears out.

4. It never becomes clogged with rubbish or ice.

5. It requires no penstock or outer iron case, and it can be bolted directly to wood or iron pipe.

6. It runs equally as well in backwater as out with same head.

7. It will not freeze in the coldest climate.

8. Any intelligent man can set it.

9. It is the steadiest running wheel made. Governor rarely needed.

10. There is little or no wear on step. Step will last for years; any worn out inside of ten years replaced free of charge.

11. Buckets are so shaped and constructed that they cannot be broken out save by iron or rocks run through it.

12. The case is solid and heavy, in a single casting, and of enormous strength. Made to last forever.

13. The gate box is made round or square, and is attached to curb so that the whole is portable.

14. For simplicity, durability and percentage of power, no other turbine can approach, much less equal it.

15. In short, it is an absolutely perfect water wheel—no more to be compared with old scroll wheels than a roller mill is with an apple grater, because they happen to look somewhat alike.

16. Every man who gets one, and it does not please him, has the privilege of exchanging it for a smaller or larger wheel, or can get his money back, just as he may prefer.

Important Notice.

In writing for information or ordering wheels, give the following:

1. Write your name, post-office address, sufficiently plain to be read.

2. Give head in feet, and kind and size of wheel you now use.

3. What kind of a mill, how many machines, and their kind?

4. Must your wheel run right hand or left?

The way the hands of a watch or clock run is right hand.

5. How much water have you? Stream light or heavy all the year.

6. Give all the facts you can in regard to mill, power, etc.

7. Give railroad station and route you want wheel shipped. When this is not given we ship by best and cheapest route. Shipping immense number of wheels, we can get good rates.

8. State whether you want a round or square gate box, and whether you want it on legs, or with a draft tube. Use a wheel with legs if you can.

9. Always get a good millwright to make out your bill of shafting and gearing and put it up.

Our Iron Clad Guarantee.

Any "Perfection" wheel, after being properly selected for the work it has to do, and properly set according to our directions, not giving entire satisfaction in every particular, or failing to fill every one of the claims on the opposite page, may be returned to us (first notifying us and giving us an opportunity to find out what is wrong, and remedy it), and we will promptly, without a word, return all the money we have received for it. And if the freight receipts are sent us, we will also reimburse the mill owner for the freight he has paid, thus insuring him against all loss.

Note.

We have tried to make the above guarantee as strong as words can make it. Where our firm is known no guarantee is needed, but as we sell wheels all over the world, and our circulars are daily going into new hands, we give the above so as to make every man who entrusts an order to us perfectly safe.

Any one can satisfy himself of our responsibility through any mercantile agency or his own banking house.

Our works are an old established one, dating from 1840, and they have been under the present management for the last thirty-three years, so that no one need hesitate in entrusting their contracts to us, as they will in every case be fulfilled to the letter.

No one runs any risk in selecting the "Perfection," as all risk is assumed by us.

Price List of Double "Perfection."

These prices are for wheels as shown on front cover and next page.

First column gives size of wheel; second column, the price; third column, the area of opening that will discharge the same amount of water as wheels used under the same head; fourth column, the depth of tail-water above sheeting; fifth column, the diameter of round pipe to supply it.

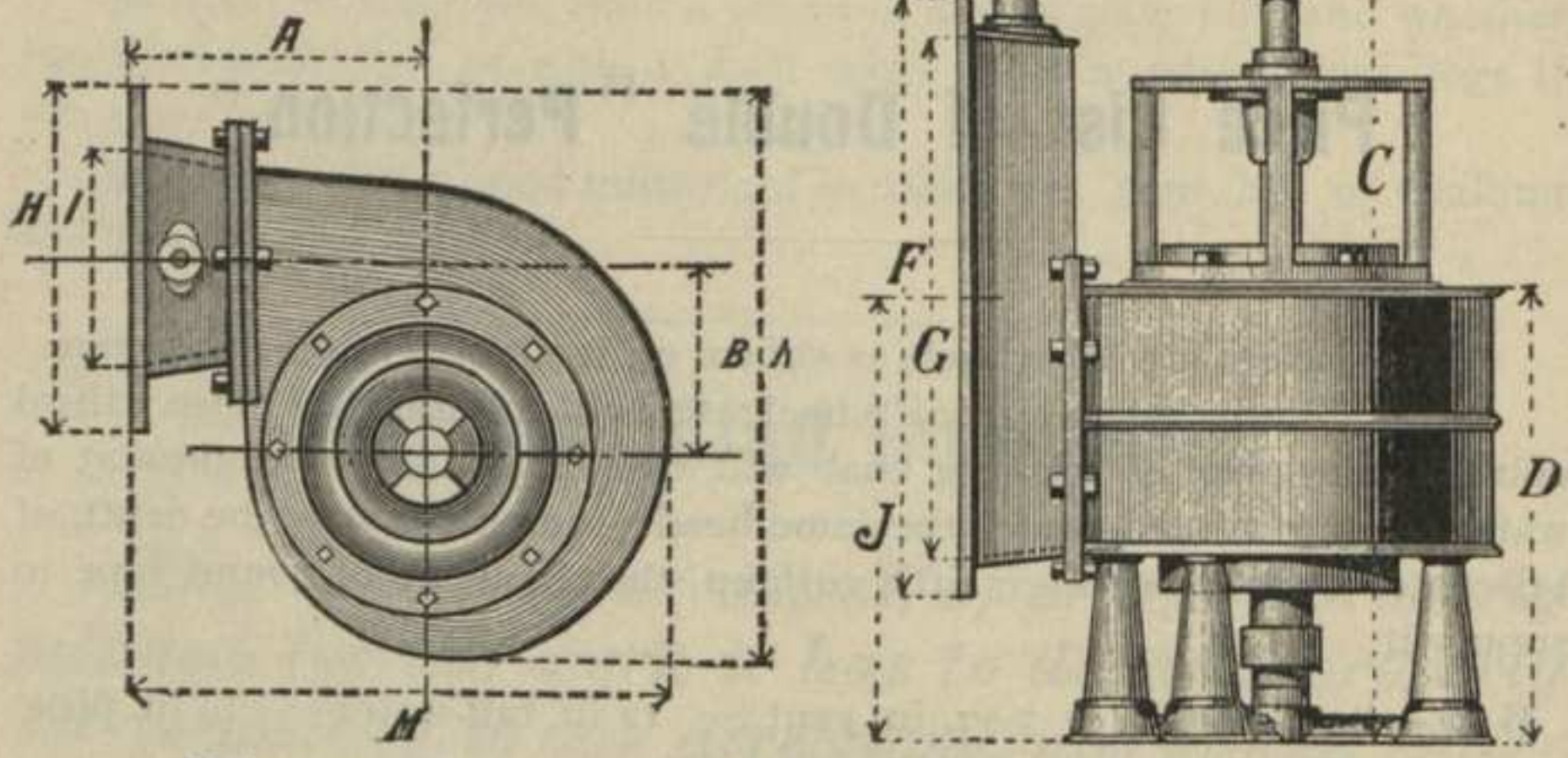
6 in. wheel	**$165**	7 sq. in. vent.	12 in. tail-water	14 in. pipe.
8 " "	**180**	13 " "	14 " "	15 " "
10 " "	**195**	18 " "	20 " "	16 " "
12 " "	**210**	32 " "	24 " "	20 " "
14 " "	**225**	42 " "	30 " "	24 " "
16 " "	**240**	60 " "	31 " "	30 " "
18 " "	**250**	72 " "	34 " "	32 " "
21 " "	**290**	90 " "	37 " "	36 " "
24 " "	**325**	128 " "	41 " "	40 " "
27 " "	**435**	160 " "	44 " "	44 " "
30 " "	**550**	200 " "	50 " "	48 " "
36 " "	**700**	284 " "	66 " "	54 " "
42 " "	**875**	406 " "	71 " "	60 " "

☞ **In ordering, state whether the wheel turns right- or left-hand.**

Our prices are made without regard to the prices of other wheels. We furnish them at a fair profit on the cost of manufacturing. We solicit only the trade of those who want the best. Our wheel is far superior to any other, and has no afterclaps in the shape of expensive repairs. It saves its cost over any other wheel, in that it needs no penstock, and on that account is the cheapest wheel in the world.

Remember this in comparing prices with the cheap rattle-traps whose only recommendation is their low price. A poor water-wheel is dear as a gift, for it costs just as much to put in a poor one as a good one, and in all other wheels than a "Perfection," the cost of building a penstock is generally as much and often more than the cost of the wheel.

In ordering never neglect to state whether wheel turns right-hand or left. The way the hands of a watch turn is right-hand.



Dimensions and Weights of Double "Perfection" Water Wheels.

A, distance from centre of wheel to face of gate box. **B**, distance from centre of gate box to centre of wheel. **C**, height from floor to centre of coupling. **D**, depth of tail water. **E**, bore of upper half of coupling. **F** and **H**, outside of gate box flange. **G** and **I**, inside of gate box. **J**, from floor to centre of gate box. **M** and **N**, space taken up by wheel. All measurements in inches.

Diam.	A	B	C	D	E	F	H	G	I	J	M	N	Shipping Weight
6	8¼	4¼	25½	12	1¼	20¼	10¾	16¼	6⅞	12	13¾	14	175
8	10	5½	29	14	1¼	25¾	12¼	21	8¼	14½	17	18	285
10	11½	6½	44	20	1⅞	29⅛	11	25¼	7⅛	21½	20½	20	475
12	12	7½	48	24	1⅞	37⅜	13⅝	33⅛	9⅜	24¾	22¼	24½	650
14	13⅛	9¼	55½	30	2	44½	15	40½	9¼	29¾	25½	26½	950
16	15¾	10¼	56	31	2¼	44	19	39¼	11	32½	30½	33	1040
18	16	11¾	65½	34	2¼	48⅞	17	44	11¼	35¾	33½	34	1500
21	18½	14⅝	69½	37	2⅝	51½	19½	46½	13	37½	39½	41	2000
24	20½	15¼	75	41	2¾	55½	21¼	50¼	14¾	42	41	44	2180
27	22½	17¾	80½	44	3⅛	62	23	57	16	46	46½	49½	2770
30	24½	19	87½	50	3⅛	65	24¾	60	17½	50¾	51	54	3290
36	These sizes of Double Wheels are specially made to suit each location. Dimensions and Weights will be furnished.												
42													
48													
54													

TABLES FOR DOUBLE "PERFECTIONS."

Remember at three-quarters gate these wheels use three-quarters the amount of water and give three-quarters the power. At half-gate they give one-half the power and use one-half the water. The revolutions are same for all gateages.

Head	6 IN. DOUBLE WHEEL.			8 IN. DOUBLE WHEEL.			10 IN. DOUBLE WHEEL.		
	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.
1	.18	40	194	.20	52	190	.24	88	130
2	.28	46	251	.32	66	241	.38	112	174
3	.38	76	314	.42	81	313	.48	136	207
4	.48	80	361	.60	94	365	.68	156	241
5	.52	84	417	.86	105	444	1.08	174	267
6	.66	87	464	1.10	115	446	1.46	190	294
7	.82	90	509	1.36	126	448	1.96	206	318
8	.96	93	552	1.64	136	451	2.32	224	340
9	1.16	95	578	1.96	144	472	2.86	236	360
10	1.36	97	624	2.00	151	498	3.40	250	388
11	1.54	98	658	2.60	159	523	4.00	262	399
12	1.76	100	690	3.24	165	546	4.60	272	416
13	1.96	102	721	3.42	172	568	5.36	282	433
14	2.16	103	750	3.86	178	590	5.98	294	449
15	2.42	105	779	4.48	184	610	6.80	302	465
16	2.64	109	806	4.86	191	630	7.40	314	480
17	2.88	111	832	5.28	197	650	8.00	324	495
18	3.16	113	869	5.76	207	668	8.80	332	509
19	3.44	115	883	6.30	214	687	9.60	342	523
20	3.70	117	907	6.62	218	704	10.44	350	537
21	3.94	121	931	7.24	224	722	11.24	358	550
22	4.26	123	954	7.82	228	739	12.12	366	568
23	4.54	125	976	8.24	235	756	12.98	374	575
24	4.88	127	998	8.86	239	772	13.86	382	588
25	5.16	129	1019	9.42	243	788	14.30	390	600
26	5.44	131	1046	10.18	247	803	15.08	398	612
27	5.82	133	1061	10.72	252	819	16.28	406	623
28	6.12	135	1081	11.22	256	835	17.16	412	635
29	6.42	137	1101	11.86	262	848	18.16	420	646
30	6.74	139	1120	12.44	266	863	19.04	428	658
31	7.04	141	1140	13.18	270	877	20.24	434	668
32	7.38	143	1158	13.66	275	891	21.28	442	679
33	7.72	145	1177	14.30	279	905	22.32	448	689
34	8.16	147	1197	15.08	283	919	23.26	454	700
35	8.50	149	1215	15.62	294	932	24.50	464	710
36	8.86	151	1233	16.32	298	945	25.48	470	720
37	9.22	153	1251	17.02	302	958	26.76	474	730
38	9.58	155	1268	17.64	304	971	27.88	480	740
39	9.96	157	1285	18.42	306	984	28.96	486	748
40	10.34	159	1301	19.08	311	996	30.38	492	759

For heads greater than the tables, see page 86.

TABLES FOR DOUBLE "PERFECTIONS."

Remember at three-quarters gate these wheels use three-quarters the amount of water and give three-quarters the power. At half gate they give one-half the power and use one-half the water. The revolutions are same for all gateages.

Head	6 IN. DOUBLE WHEEL.			8 IN. DOUBLE WHEEL.			10 IN. DOUBLE WHEEL.		
	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.
41	10.72	160	1318	19.64	315	1008	31.52	498	768
42	11.10	162	1334	20.24	319	1020	32.76	506	776
43	11.50	165	1380	20.48	323	1033	34.18	512	785
44	11.90	168	1366	21.24	327	1047	35.30	516	794
45	12.32	170	1382	21.86	331	1057	35.98	522	803
46	12.76	172	1398	22.28	335	1069	36.46	528	812
47	13.16	174	1414	22.88	339	1080	37.12	532	821
48	13.58	176	1430	24.00	343	1090	38.14	538	830
49	14.02	178	1444	24.44	347	1102	39.10	544	838
50	14.46	180	1460	24.92	351	1114	40.96	550	847
51	14.90	182	1476	25.66	355	1126	42.12	556	855
52	15.38	184	1492	26.72	359	1134	43.26	560	864
53	15.82	186	1502	27.44	363	1144	44.16	566	872
54	16.28	189	1517	28.18	367	1154	45.66	572	880
55	16.74	191	1533	29.06	371	1164	47.34	576	888
56	17.22	193	1548	30.24	375	1178	49.18	582	896
57	17.62	195	1560	31.06	386	1191	50.96	586	904
58	18.02	197	1574	32.20	390	1201	52.18	592	912
59	18.52	199	1590	33.44	394	1210	53.78	596	920
60	19.02	201	1600	34.28	399	1218	55.30	600	928
61	19.52	203	1614	34.86	403	1228	56.86	606	936
62	20.02	205	1627	35.92	405	1238	58.00	612	943
63	20.54	207	1639	36.66	409	1248	59.62	616	951
64	20.98	210	1652	37.28	413	1258	61.20	622	958
65	21.40	212	1666	38.30	417	1268	64.30	628	965
66	21.94	214	1678	39.06	422	1279	67.68	632	973
67	22.48	216	1691	39.92	426	1288	69.24	636	980
68	23.02	218	1704	40.62	430	1298	70.32	642	988
69	23.44	220	1718	41.06	434	1307	71.10	646	995
70	23.90	222	1730	41.74	438	1316	72.18	650	1002
71	24.48	224	1742	42.92	443	1325	75.44	652	1009
72	25.04	226	1754	44 34	447	1334	76.54	656	1016
73	25.62	228	1778	45.28	451	1343	78.00	662	1023
74	26.16	230	1780	47.16	455	1352	81.60	668	1030
75	26.54	232	1792	48.36	459	1361	82.36	672	1037
76	27.14	234	1804	49.24	464	1372	83.26	676	1044
77	27.72	236	1816	50.60	466	1381	84.90	680	1051
78	28.20	238	1828	51.28	470	1390	86.08	684	1058
79	28.70	240	1840	52.36	474	1398	88.10	688	1065
80	29.30	242	1852	53.30	478	1406	89.92	692	1072

For heads greater than the tables, see page 86.

TABLES FOR DOUBLE "PERFECTIONS."

Remember at three-quarters gate these wheels use three-quarters the amount of water and give three-quarters the power. At half gate they give one-half the power and use one-half the water. The revolutions are same for all gateages.

Head	12 IN. DOUBLE WHEEL.			14 IN. DOUBLE WHEEL.			16 IN. DOUBLE WHEEL.		
	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.
1	.20	104	112	.24	149	87	.32	266	74
2	.50	140	144	.78	215	120	.80	298	110
3	.90	176	176	1.16	257	153	1.52	332	136
4	1.36	200	204	1.86	303	171	2.38	392	158
5	1.82	222	227	2.52	334	198	3.36	426	176
6	2.64	242	250	3.34	367	217	4.42	468	193
7	3.30	260	271	4.32	398	231	5.66	506	208
8	3.86	282	288	5.08	424	248	7.00	520	223
9	4.52	304	307	6.94	457	261	8.34	574	236
10	5.30	318	327	7.88	477	279	9.76	604	249
11	6.00	334	340	9.00	503	294	11.22	632	261
12	7.08	350	358	9.96	523	311	12.84	662	273
13	8.02	366	368	11.62	550	319	14.50	688	284
14	9.10	380	382	13.12	587	328	16.24	714	295
15	9.76	394	396	14.28	607	338	18.00	740	305
16	10.78	408	405	15.66	624	350	19.78	764	315
17	11.72	420	419	17.06	640	362	20.76	786	.325
18	12.78	432	431	18.46	657	373	23.58	810	334
19	13.82	442	444	20.08	672	384	25.66	832	343
20	15.26	452	459	21.56	688	394	27.68	854	352
21	16.38	462	467	23.10	706	405	29.78	874	361
22	17.36	472	478	24.26	719	414	31.60	894	369
23	18.48	482	489	26.52	734	424	34.20	916	378
24	19.78	492	501	28.74	750	433	36.38	936	386
25	21.08	502	510	29.78	763	443	38.54	956	394
26	21.80	513	519	31.56	778	451	40.92	976	402
27	23.90	521	530	33.88	794	460	43.32	998	409
28	25.18	532	541	35.36	803	470	45.96	1018	417
29	26.00	543	549	37.40	818	478	48.40	1036	424
30	27.30	551	560	39.34	831	487	50.56	1055	431
31	29.16	562	570	41.00	844	495	53.50	1074	439
32	30.00	572	579	43.00	858	503	56.16	1093	446
33	31.66	578	585	45.22	871	511	58.84	1113	453
34	33.22	590	596	47.16	884	519	60.86	1133	459
35	34.52	598	608	49.26	897	527	63.92	1154	466
36	36.00	608	615	51.00	904	536	65.34	1173	473
37	37.00	620	622	53.16	917	543	67.88	1194	479
38	39.60	632	630	55.22	943	551	70.20	1214	486
39	41.84	644	639	57.24	954	579	73.40	1234	492
40	42.95	658	648	58.62	963	586	76.00	1249	498

For heads greater than the tables, see page 86.

TABLES FOR DOUBLE "PERFECTIONS."

Remember at three-quarters gate these wheels use three-quarters the amount of water and give three-quarters the power. At half gate they give one-half the power and use one-half the water. The revolutions are same for all gateages.

Head	12 IN. DOUBLE WHEEL.			14 IN. DOUBLE WHEEL.			16 IN. DOUBLE WHEEL.		
	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.
41	45.92	672	658	60.80	976	593	77.26	1259	504
42	47.74	686	665	62.64	986	601	79.44	1268	509
43	49.64	696	674	64.80	998	607	82.60	1277	515
44	51.20	704	682	66.40	1012	613	84.46	1288	521
45	52.82	712	690	70.02	1020	620	87.12	1300	528
46	54.76	720	698	73.00	1030	626	89.56	1314	535
47	56.20	730	706	76.22	1042	633	92.42	1328	541
48	58.22	742	714	78.24	1050	640	94.62	1339	548
49	59.80	754	720	81.00	1060	646	97.16	1350	555
50	63.30	764	727	82.50	1070	652	99.74	1360	561
51	64.38	776	735	85.60	1080	658	102.3	1370	567
52	67.00	788	743	87.80	1088	664	104.8	1378	573
53	70.22	798	750	89.74	1100	670	107.5	1392	579
54	72.82	808	757	92.22	1108	676	110.6	1402	586
55	76.22	820	764	95.14	1118	682	112.8	1418	593
56	78.38	832	771	97.50	1128	688	115.8	1432	599
57	80.66	844	778	100.5	1138	694	118.2	1442	607
58	81.82	856	785	102.9	1150	702	121.5	1456	614
59	83.02	866	792	104.2	1160	706	124.2	1470	620
60	85.32	876	799	106.2	1172	712	127.7	1482	626
61	87.34	888	806	110.0	1176	718	132.2	1490	632
62	89.64	898	813	112.6	1182	724	136.8	1498	638
63	92.00	908	819	115.2	1194	730	140.6	1504	644
64	94.82	920	826	117.8	1202	735	143.8	1530	650
65	97.24	928	832	120.2	1214	740	146.7	1542	657
66	100.2	938	838	124.6	1222	746	149.6	1552	662
67	102.7	948	845	127.8	1234	751	152.5	1564	668
68	105.0	956	851	130.0	1242	757	155.9	1574	675
69	107.5	964	858	132.2	1254	762	158.4	1584	681
70	110.2	974	864	134.6	1262	768	160.7	1596	688
71	112.8	982	870	137.0	1268	773	164.3	1608	695
72	115.2	990	876	140.4	1272	778	167.4	1618	701
73	117.8	1000	882	144.8	1280	783	170.3	1632	707
74	120.2	1008	888	146.4	1286	788	173.7	1644	712
75	124.2	1018	895	149.6	1292	793	176.8	1656	718
76	126.8	1026	902	152.0	1304	798	180.2	1668	724
77	130.2	1036	908	154.8	1314	803	183.2	1682	731
78	132.2	1046	914	157.8	1328	808	186.2	1696	738
79	134.6	1056	920	161.0	1336	813	189.6	1704	745
80	137.0	1065	926	164.2	1342	818	192.6	1712	752

For heads greater than the tables, see page 86.

TABLES FOR DOUBLE "PERFECTIONS."

Remember at three-quarters gate these wheels use three-quarters the amount of water and give three-quarters the power. At half gate they give one-half the power and use one-half the water. The revolutions are same for all gateages.

Head	18 IN. DOUBLE WHEEL.			21 IN. DOUBLE WHEEL.			24 IN. DOUBLE WHEEL.		
	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.
1	.42	258	65	.72	338	60	.88	264	55
2	1.08	312	97	1.84	442	85	1.94	578	75
3	1.98	364	119	2.82	546	105	3.78	692	90
4	3.02	432	138	4.22	626	121	5.46	794	105
5	4.38	488	153	5.82	700	136	7.64	882	115
6	5.68	560	167	7.36	760	149	9.68	960	126
7	7.26	610	180	9.58	824	162	12.36	1040	136
8	8.60	642	192	11.56	886	174	15.02	1110	147
9	9.98	682	204	13.84	936	184	17.92	1158	156
10	11.92	720	215	16.20	990	194	21.14	1260	164
11	13.74	758	228	18.42	1026	204	24.00	1302	172
12	15.38	832	237	21.66	1080	213	27.44	1366	179
13	17.56	886	247	23.92	1130	221	31.42	1418	187
14	19.66	900	258	26.80	1172	230	34.62	1470	193
15	21.92	932	267	30.00	1214	238	38.46	1520	200
16	23.88	964	276	33.64	1248	245	41.98	1570	206
17	26.00	986	282	35.80	1292	253	46.02	1640	213
18	29.72	1024	293	38.38	1328	260	50.36	1680	219
19	32.42	1052	302	41.84	1364	267	54.50	1709	225
20	35.66	1080	311	45.74	1400	274	58.92	1759	230
21	37.94	1102	318	49.92	1434	281	63.42	1800	236
22	39.64	1124	325	52.02	1468	288	67.94	1840	241
23	41.80	1150	332	55.74	1500	294	73.28	1880	247
24	44.12	1174	339	59.64	1534	301	77.78	1920	252
25	47.88	1198	345	63.62	1566	307	82.08	1960	257
26	49.76	1222	351	67.24	1596	313	87.76	2000	262
27	51.94	1244	357	70.62	1626	319	92.62	2044	267
28	54.94	1264	363	75.60	1656	324	97.84	2082	272
29	57.62	1284	370	78.94	1686	330	102.9	2119	277
30	61.80	1308	377	83.24	1716	336	107.9	2154	281
31	64.30	1330	383	87.66	1744	341	113.6	2190	286
32	67.76	1348	389	91.44	1772	347	119.4	2226	290
33	70.00	1368	395	95.66	1800	352	125.6	2258	295
34	73.46	1388	401	99.94	1828	358	130.0	2288	299
35	76.84	1408	406	105.6	1854	363	135.9	2328	303
36	79.94	1428	412	109.4	1880	368	140.7	2364	308
37	83.82	1446	417	113.8	1906	373	147.9	2408	312
38	87.30	1464	423	117.8	1932	378	153.9	2448	316
39	90.30	1482	428	122.8	1956	383	159.9	2496	320
40	94.02	1500	434	127.6	1982	388	166.2	2576	324

For heads greater than the tables, see page 86.

TABLES FOR DOUBLE "PERFECTIONS."

Remember at three-quarters gate these wheels use three-quarters the amount of water and give three-quarters the power. At half gate they give one-half the power and use one-half the water. The revolutions are same for all gateages.

Head	27 IN. DOUBLE WHEEL.			30 IN. DOUBLE WHEEL.			36 IN. DOUBLE WHEEL.		
	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.
1	1.02	422	50	1.12	636	45	2.16	1040	40
2	2.74	798	65	3.15	924	60	4.58	1340	50
3	4.58	908	79	5.72	1134	73	8.08	1640	60
4	6.90	1052	94	8.40	1304	84	12.22	1896	69
5	9.54	1178	107	11.68	1520	94	16.90	2000	78
6	13.00	1292	116	15.28	1600	102	22.10	2314	89
7	15.78	1398	125	19.20	1730	110	27.88	2482	95
8	19.20	1496	133	23.24	1852	118	33.84	2656	102
9	22.88	1588	141	27.90	1964	124	40.26	2816	108
10	26.66	1672	148	32.64	2072	131	47.12	2976	113
11	30.78	1758	155	37.62	2174	137	54.28	3122	118
12	35.38	1836	162	42.86	2272	144	60.86	3258	123
13	39.52	1912	168	48.30	2366	150	69.74	3396	127
14	43.92	1986	174	53.94	2458	156	77.78	3526	132
15	49.06	2056	180	59.78	2540	162	86.20	3650	136
16	53.36	2124	186	65.84	2620	167	95.94	3772	140
17	59.04	2190	192	72.16	2710	172	103.8	3888	144
18	64.04	2254	197	78.56	2788	176	112.1	4002	148
19	69.20	2316	202	85.16	2862	181	122.7	4112	152
20	75.08	2376	207	91.98	2940	186	132.5	4220	156
21	80.50	2436	212	98.92	3012	190	142.5	4326	159
22	86.60	2494	217	106.0	3084	194	152.8	4428	163
23	91.94	2550	222	113.3	3156	198	163.3	4528	166
24	98.00	2606	226	120 8	3222	202	174.0	4626	170
25	103.9	2660	231	128.4	3288	206	185.0	4722	173
26	110.6	2712	235	136.2	3354	210	197.2	4816	178
27	116.8	2766	240	144.1	3418	214	207.6	4910	180
28	122 4	2816	244	152.2	3482	218	219.2	5000	183
29	129.9	2866	248	160.4	3544	220	231.0	5090	186
30	137.1	2916	252	168.6	3604	225	243.2	5180	189
31	143.8	2964	256	177.2	3664	229	255.2	5264	192
32	151.1	3012	260	185.8	3724	233	267.6	5348	195
33	157.7	3058	264	194.5	3780	236	281.0	5434	198
34	165.5	.3106	268	203.4	.3836	240	293.8	5516	201
35	172.6	3152	272	212.4	3894	243	306.8	5600	203
36	179.9	3196	276	221.6	3950	246	319 4	5676	206
37	187.5	3240	280	231.0	4002	250	332.8	5734	209
38	195.5	3284	284	240 4	4056	253	346.4	5832	212
39	202.7	3328	287	250.0	4110	256	360.4	5908	214
40	210.9	3370	290	260.0	4158	260	374 0	5980	216

For heads greater than the tables, see page 86.

TABLES FOR DOUBLE "PERFECTIONS."

Remember at three-quarters gate these wheels use three-quarters the amount of water and give three-quarters the power. At half gate they give one-half the power and use one-half the water. The revolutions are same for all gateages.

Head	42 IN. DOUBLE WHEEL.			48 IN. DOUBLE WHEEL.			54 IN. DOUBLE WHEEL.		
	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.	Horse Power.	Cu. ft. at full gate.	Rev. per Min.
1	3.4	1380	33	4.0	1940	30	7.6	2398	27
2	6.0	1904	43	7.8	2482	40	10.4	3104	36
3	5.6	2338	53	14.4	3024	48	18.6	3830	43
4	17.2	2704	62	21.8	3496	55	27.8	4406	50
5	24.0	3024	71	30.8	3916	62	41.6	4894	55
6	31.4	3316	78	40.2	4256	67	51.8	5404	60
7	39.6	3584	83	50.8	4580	72	65.0	5838	64
8	48.0	3830	89	62.0	4912	76	77.0	6242	68
9	57.4	4054	93	74.0	5216	80	94.2	6628	71
10	67.2	4288	97	87.4	5496	84	110.4	6984	74
11	77.4	4498	101	100.2	5766	88	127.0	7330	78
12	88.2	4698	105	114.4	6020	91	144.4	7660	81
13	99.4	4890	109	129.8	6266	95	162.6	7966	84
14	111.0	5076	113	144.2	6504	98	183.6	8276	87
15	123.2	5256	117	160.6	6732	101	201.0	8570	90
16	135.8	5430	120	175.8	6952	104	221.6	8852	93
17	148.4	5596	124	192.2	7168	107	242.6	9124	95
18	161.6	5760	127	209.6	7376	110	264.2	9596	98
19	175.4	5920	130	227.2	7576	113	286.6	9652	101
20	189.4	6074	134	245.4	7772	116	309.4	9902	103
21	203.6	6222	137	262.8	7964	119	333.0	10148	106
22	218.4	6372	140	283.0	8150	121	357.0	10388	108
23	233.4	6512	143	302.4	8334	124	381.4	10622	110
24	248.8	6654	146	322.4	8514	127	406.4	10852	112
25	264.2	6790	148	342.8	8692	129	432.0	11076	115
26	280.4	6926	151	363.8	8862	132	458.2	11298	117
27	296.6	7056	154	384.6	9030	134	484.8	11514	119
28	313.4	7186	157	405.6	9196	136	511.8	11724	121
29	330.2	7316	159	427.8	9358	139	539.6	11934	123
30	347.4	7442	162	449.8	9520	141	567.6	12138	125
31	364.8	7566	165	472.2	9676	143	598.4	12340	127
32	382.6	7686	167	495.8	9832	145	625.0	12536	129
33	400.8	7808	170	519 0	9984	148	654.8	12732	131
34	419.2	7924	172	542.8	10136	150	684.4	12924	133
35	437.8	8040	175	567.0	10286	152	714 8	13114	135
36	456.6	8154	178	590.4	10428	154	745.6	13300	137
37	475.6	8266	182	615.8	10574	158	777.0	13484	139
38	495.2	8398	184	641.6	10714	160	808.6	13666	141
39	514.8	8488	186	666.0	10852	162	840.2	13844	143
40	534.6	8584	189	704.8	10992	164	873 6	14022	145

For heads greater than the tables, see page 86.

Five Great Points.

We ask every man who contemplates the purchase of a water-wheel to carefully read the following:

1st.—Saving in the Use of Water.

We offer you the testimony of hundreds who are using them on the lightest of streams through one of the dryest summers ever known to prove the "Perfection" the greatest of water savers. We offer you the tests in the scientific testing flumes where our common ordinary wheels have given from 82 to 86 per cent. Though tested many times it has never, like all other wheels, given less than 80 per cent. While the 85 and 90 per cent. wheels often give results away down in the seventies, our 82 per cent. "Perfections" never get lower than 80 per cent. Just because they are so exceedingly simple they are all alike.

As a part gate wheel no water-wheel can surpass it. In its Double form it is the only wheel in the world that gives as high percentage at half as at full gate. We get the highest part gate results without any cog wheels, levers, rods, hinges, pistons, rubber rings, or any other machinery and clap-trap.

The fact of our little wheels being so cheap and easy to set the demand for them from parties having little mills on light streams, where every gallon of water, you might say, counts, has been simply enormous, and it is situations like these that test the efficiency and water-saving qualities of a water-wheel. We have displaced hundreds of overshots and all the so-called best water-wheels, yet in every case has the "Perfection" proved itself to be all we claim, and every man has been delighted with it. A water-wheel that will stand this severe test will answer anywhere. We take pride in the fact that the **"Perfection" never makes a miss.**

2d.—Tight Gate.

You will admit without a word that no water-wheel on the market has so perfect a gate as the "Perfection." *It don't leak a single drop.* Every mill owner who has a flume wheel knows the botheration of leaky gates. We are displacing dozens—yes, hundreds of flume wheels simply on account of their leaky gates. While other parties are throwing out wheels on this account, some parties are buying the same sort who in a few years will have to do the same. Get a good tight gate wheel. The

"Perfection" gate is tight and works so easy a child can draw it. This is one of the most important points in a turbine, and mill owners should carefully consider it.

3d.—Simplicity and Durability.

These go hand in hand. Where the first is, there will you find the second. The "Perfection" is the simplest water-wheel in the world. Everybody admits this. Consequently, it is durable. There is nothing whatever about the wheel to wear out or get out of order. **There is Not a Single Bolt Under Water.** Just to think of it,—a water-wheel without so much as a single bolt under water! What other water-wheel can say this, and what need we say further on the subject of simplicity and durability?

4th.—It Don't Clog or Freeze.

Leaves, dirt, walnuts, rubbish, etc., to be found in every mill race, and which give so much bother and trouble to other wheels, have no effect on the "Perfection." Our wheel does just as well in foul, dirty, sandy, and muddy streams, as in the clearest spring water. The sand or grit of muddy streams cannot get at the bearings, for the bottom one is a wood toe, and the upper or main bearing is entirely out of the water.

In Coal Regions, where the **Sulphur Water** soon eats out other wheels unless made wholly of brass, the "Perfection" is found the only wheel that will stand. In sections where the streams are filled with long grass and leaves in summer and fall, and with ice in winter, no trouble is had with "Perfections." In Canada and the North-west, where the thermometer gets down to twenty degrees below zero, the "Perfection" is very popular, because it does not freeze or clog with ground ice. There is no drawing off of race, no crawling into penstocks, no stoppages, no delays, and no bother of any kind with the "Perfection."

5th.—Needs No Penstock.

Last, but not least. **You save the cost.** Take the circular of any other wheel, and you find you are advised to get wheels in "outer iron" cases. They give you cuts of same, and tell you the great advantages of them. But their wheels have to go inside of these cases, out of sight. They also charge you from $50 to $150 extra for cases.

Here, in the "Perfection," we give you what every wheel builder says you ought to have, a wheel in iron case, yet you don't have to pay extra for it. Besides, our case is not like theirs, because it don't contain any machinery. You always have our wheel under your eye.

Our wheel saves the cost of elaborate wooden penstocks. All they need are spouts. The many cuts we have given in this book will impress you with the great value of our **Needing No Penstock** feature better than any words can do it.

Price List of Standard Wheels.

These prices are for our standard wheel with square gate box and on legs, as is shown on page 8 and also on opposite page.

The list also gives the area of the opening that will discharge the same amount of water the wheel uses under the same head as wheel is placed.

Price of	6	inch	wheel,	$75;	area of the discharge,		3.5	square	inches.
"	8	"	"	95;	"	"	6.5	"	"
"	10	"	"	115;	"	"	9	"	"
"	12	"	"	125;	"	"	16	"	"
"	14	"	"	140;	"	"	21	"	"
"	16	"	"	165;	"	"	30	"	"
"	18	"	"	190;	"	"	36	"	"
"	21	"	"	216;	"	"	45	"	"
"	24	"	"	250;	"	"	64	"	"
"	27	"	"	284;	"	"	80	"	"
"	30	"	"	325;	"	"	100	"	"
"	36	"	"	375;	"	"	142	"	"
"	42	"	"	458;	"	"	203	"	"
"	48	"	"		"	"	263	"	"

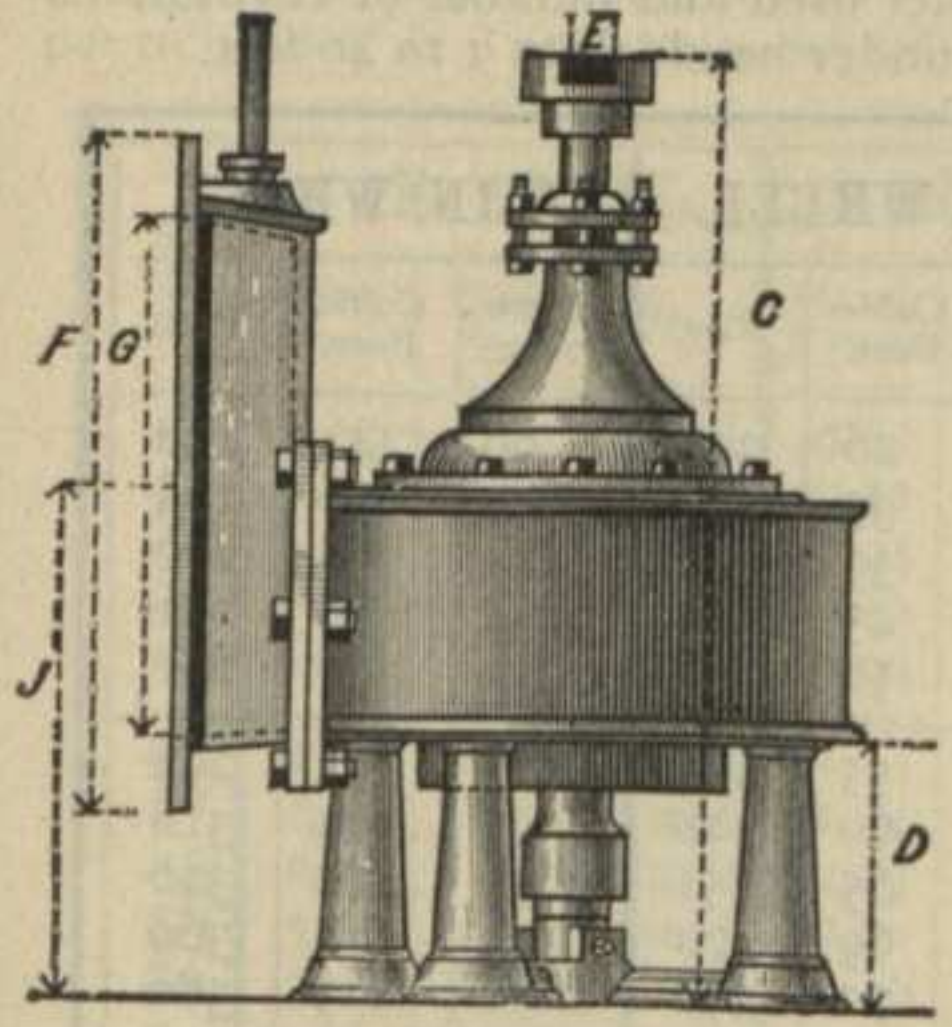
Subject to discount of per cent.

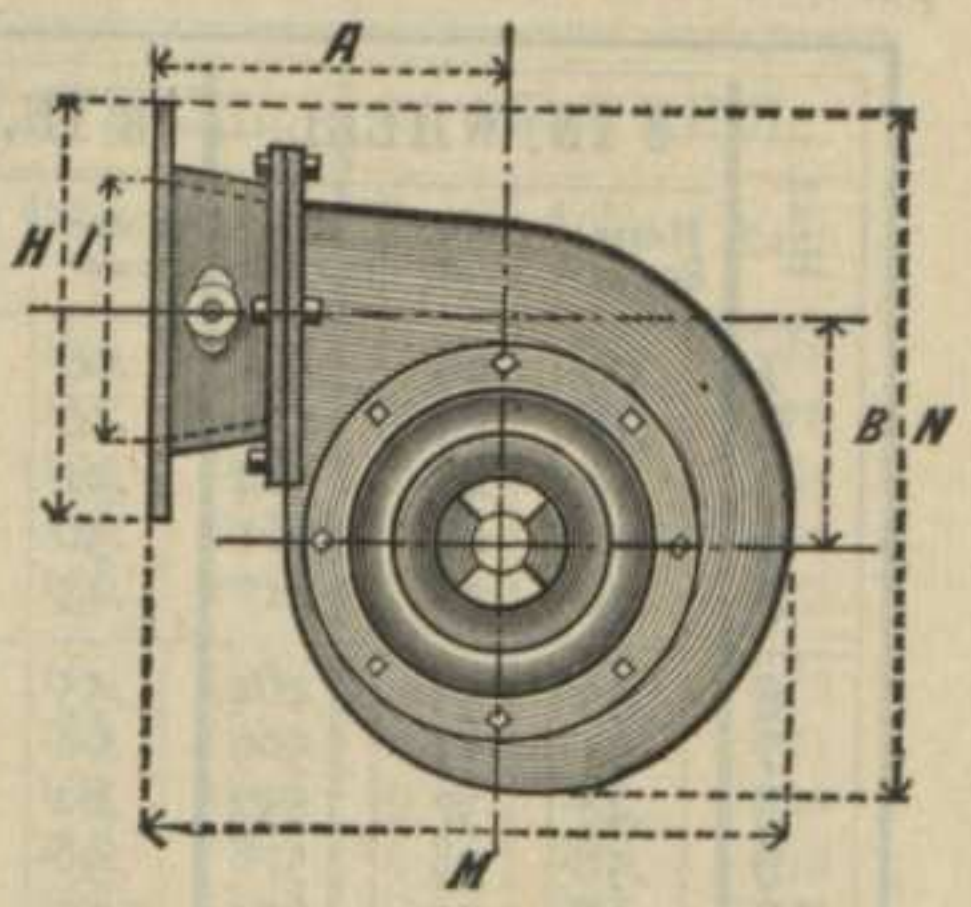
Modifications of the wheel, such as the Good Idea, Turret, Twin and Horizontal, come at various prices, according to circumstances and will be quoted on application, with full particulars.

Prices will be named for any special form of gate box or extra length of shaft, etc.

In ordering never neglect to state whether wheel turns right hand or left hand.

In comparing our prices with those of other wheels, please bear in mind that:--Its great economy in the use of water, its perfectly tight and easy gate, its great simplicity, strength and durability, its having its own outer iron case, and its low price give to the "Perfection" wheel a combination of excellencies not found in any other water-wheel.





Dimensions of Standard Wheels.

A, distance from center of wheel to face of gate box. **B**, distance from center of gate box to center of wheel. **C**, height from floor to center of couplings. **D**, height from floor to under side of curb, also is height tail-water should stand. **E**, bore of upper coupling. **F** and **H**, outside measurement of gate box flange. **G** and **I**, inside measurement of gate box. **J**, distance from floor to center of gate box. **M** and **N**, space taken up by wheel.

Diam.	A	B	C	D	E	F	H	G	I	J	M	N	Shipping Weight
6	6½	4¼	17	4¾	1¼	10⅞	7⅞	7⅞	4⅞	8¼	12	13	100 lbs.
8	8¾	5½	23¾	5	1¼	13¼	9⅝	10⅛	6⅜	9⅝	16½	15¾	140 "
10	10¼	7	31½	9⅛	1⅜	16¼	10½	12¾	7	15	18½	19¾	200 "
12	12	7½	37	10¼	1½	20½	11	16½	7	17¾	24¼	25½	300 "
14	13	9	42¾	10½	1¾	24¾	12¾	20¾	8¾	20¼	25	25½	400 "
16	15⅝	11	45¾	13¼	1¾	23½	15⅜	19⅛	10¾	22	29¼	31¼	550 "
18	16¾	11¾	50	14¼	2	25¾	15	21⅝	10¾	24	31¾	32½	700 "
21	18¼	13¾	52¾	15¼	2⅝	28¾	17¾	23¾	12½	26⅝	36	34¾	1000 "
24	20⅛	15¾	56	17½	2¾	29¼	19¼	24⅝	14¾	29¼	40	42¾	1100 "
27	21¼	17¾	62	18⅛	3⅛	33½	20¾	28½	15⅝	31¾	44	47½	1700 "
30	23½	19½	64½	20¾	3⅛	35¾	23	30½	18	35¾	49	52¾	2000 "
36	28¼	24¾	83¾	24¾	3½	48¾	25¾	43¾	20⅝	45¼	60	64	2900 "
42	33	28¾	87	29¼	4	49½	32½	44	27	50½	69	76½	4500 "
48	38	31¾	90	30	4⅞	64½	34½	56½	26½	57¾	77	84	6000 "

TABLES

Giving horse power, cubic feet of water used and number of revolutions per minute of 6, 8 and 10 in. wheels under heads from 1 to 40 feet.

Head.	6 IN. WHEEL.			8 IN. WHEEL.			10 IN. WHEEL.		
	Horse Power.	Cubic Feet.	Rev. per Min	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.
1	.09	20	194	.06	26	212	.09	44	130
2	.14	23	251	.16	33	261	.19	56	174
3	.19	26	314	.21	39	313	.24	68	207
4	.24	28	361	.30	45	365	.34	78	241
5	.26	30	417	.43	50	444	.54	87	267
6	.33	33	464	.55	55	446	.73	95	294
7	.41	35	509	.68	60	448	.96	103	318
8	.48	37	552	.82	65	451	1.16	112	340
9	.58	38	578	.98	69	472	1.43	118	360
10	.68	40	624	1.00	72	498	1.70	125	380
11	.77	42	658	1.30	76	523	2.00	131	399
12	.88	43	690	1.62	79	546	2.30	136	416
13	.98	45	721	1.71	82	568	2.68	141	433
14	1.08	46	750	1.93	85	590	2.99	147	449
15	1.21	48	779	2.24	88	610	3.40	151	465
16	1.32	49	806	2.43	91	630	3.70	157	480
17	1.44	51	832	2.64	94	650	4.00	162	495
18	1.58	52	869	2.88	99	668	4.40	166	509
19	1.72	53	883	3.15	102	687	4.80	171	523
20	1.85	54	907	3.31	104	704	5.22	175	537
21	1.97	56	931	3.62	107	722	5.62	179	550
22	2.13	57	954	3.91	109	739	6.06	183	568
23	2.27	58	976	4.12	112	756	6.49	187	575
24	2.44	59	998	4.43	114	772	6.93	191	588
25	2.58	60	1019	4.71	116	788	7.15	195	600
26	2.72	61	1046	5.09	118	803	7.54	199	612
27	2.91	62	1061	5.36	120	819	8.14	203	623
28	3.06	64	1081	5.61	122	835	8.58	206	635
29	3.21	65	1101	5.93	125	848	9.08	210	646
30	3.37	66	1120	6.22	127	863	9.52	214	658
31	3.52	67	1140	6.54	129	877	10.12	217	668
32	3.69	68	1158	6.83	131	891	10.64	221	679
33	3.86	69	1177	7.15	133	905	11.16	224	689
34	4.08	70	1197	7.54	135	919	11.63	227	700
35	4.25	71	1215	7.81	140	932	12.25	232	710
36	4.43	72	1233	8.16	142	945	12.74	235	720
37	4.61	73	1251	8.51	144	958	13.38	237	730
38	4.79	74	1268	8.82	145	971	13.94	240	740
39	4.98	75	1285	9.21	146	984	14.48	243	748
40	5.17	76	1301	9.54	148	996	15.19	246	759

For heads greater than the tables, see page 86.

TABLES

Giving horse power, cubic feet of water used and number of revolutions per minute of 6, 8 and 10 in. wheels under heads from 41 to 80 feet.

Head.	6 IN. WHEEL.			8 IN. WHEEL.			10 IN. WHEEL.		
	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.
41	5.36	77	1318	9.82	150	1008	15.76	249	768
42	5.55	78	1334	10.12	152	1020	16.38	253	776
43	5.75	79	1380	10.24	154	1033	17.09	256	785
44	5.95	80	1366	10.62	156	1047	17.65	258	794
45	6.16	81	1382	10.93	158	1057	17.99	261	803
46	6.38	82	1398	11.14	160	1069	18.23	264	812
47	6.58	83	1414	11.44	162	1080	18.56	266	821
48	6.79	84	1430	12.05	164	1090	19.07	269	830
49	7.01	85	1444	12.22	166	1102	19.55	272	838
50	7.23	86	1460	12.46	168	1114	20.48	275	847
51	7.45	87	1476	12.83	170	1126	21.06	278	855
52	7.68	88	1492	13.36	172	1134	21.63	280	864
53	7.91	89	1502	13.72	174	1144	22.08	283	872
54	8.14	90	1517	14.09	176	1154	22.83	286	880
55	8.37	91	1533	14.53	178	1164	23.67	288	888
56	8.61	92	1548	15.12	180	1178	24.59	291	896
57	8.81	93	1560	15.53	184	1191	25.48	293	904
58	9.01	94	1574	16.10	186	1201	26.09	296	912
59	9.26	95	1590	16.72	188	1210	26.89	298	920
60	9.51	96	1600	17.14	190	1218	27.65	300	928
61	9.76	97	1614	17.43	192	1228	28.43	303	936
62	10.01	98	1627	17.96	193	1238	29.00	306	943
63	10.27	99	1639	18.33	195	1248	29.81	308	951
64	10.49	100	1652	18.64	197	1258	30.60	311	958
65	10.70	101	1666	19.15	199	1268	32.15	314	965
66	10.97	102	1678	19.53	201	1279	33.84	316	973
67	11.24	103	1691	19.96	203	1288	34.62	318	980
68	11.51	104	1704	20.31	205	1298	35.16	321	988
69	11.72	105	1718	20.53	207	1307	35.55	323	995
70	11.95	106	1730	20.87	209	1316	36.09	325	1002
71	12.24	107	1742	21.46	211	1325	37.72	326	1009
72	12.52	108	1754	22.17	213	1334	38.27	328	1016
73	12.81	109	1778	22.64	215	1343	39.00	331	1023
74	13.08	110	1780	23.58	217	1352	40.80	334	1030
75	13.27	111	1792	24.18	219	1361	41.18	336	1037
76	13.57	112	1804	24.62	221	1372	41.63	338	1044
77	13.86	113	1816	25.30	222	1381	42.45	340	1051
78	14.10	114	1828	25.64	224	1390	43.04	342	1058
79	14.35	115	1840	26.18	226	1398	44.05	344	1065
80	14.65	116	1852	26.65	228	1406	44.96	346	1072

For heads greater than the tables, see page 86.

TABLES

Giving horse power, cubic feet of water used and number of revolutions per minute of 12, 14 and 16 in. wheels under heads from 1 to 40 feet.

Head.	12 IN. WHEEL.			14 IN. WHEEL.			16 IN. WHEEL.		
	Horse Power.	Cubic Feet.	Rev. per Min	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.
1	.10	52	112	.12	68	87	.16	121	74
2	.25	70	144	.39	98	120	.40	136	110
3	.45	88	176	.58	117	153	.76	151	136
4	.68	100	204	.93	138	171	1.19	174	158
5	.91	111	227	1.26	152	198	1.68	194	176
6	1.32	121	250	1.67	167	217	2.21	213	193
7	1.65	130	271	2.16	181	231	2.83	230	208
8	1.93	141	288	2 54	193	248	3.50	246	223
9	2.26	152	307	3.47	208	261	4.17	261	236
10	2.65	159	327	3.94	217	279	4.88	275	249
11	3.00	167	340	4.50	229	294	5.61	288	261
12	3.54	175	358	4.98	238	311	6.42	301	273
13	4.01	183	368	5.81	250	319	7.25	313	284
14	4.55	190	382	6.56	267	328	8.12	325	295
15	4.88	197	396	7.14	276	338	9.00	337	305
16	5.39	204	405	7.83	284	350	9.89	348	315
17	5.86	210	419	8.53	291	362	10.38	358	325
18	6.39	216	431	9.23	299	373	11.79	369	334
19	6.91	221	444	10.04	306	384	12.83	379	343
20	7.63	226	459	10.78	313	394	13.84	389	352
21	8.19	231	467	11.55	321	405	14.89	398	361
22	8.68	236	478	12.13	327	414	15.80	407	369
23	9.24	241	489	13.26	334	424	17.10	417	378
24	9.89	246	501	14.37	341	433	18.19	426	386
25	10.54	251	510	14.89	347	443	19.27	435	394
26	10.90	256	519	15.78	354	451	20.46	444	402
27	11.95	261	530	16.94	360	460	21.66	452	409
28	12.59	266	541	17.68	365	470	22.98	461	417
29	13.00	271	549	18.70	372	478	24.20	469	424
30	13.65	276	560	19.67	378	487	25.48	478	431
31	14.58	281	570	20.50	384	495	26.75	485	439
32	14.98	286	579	21.50	390	503	28.08	493	446
33	15.83	289	585	22.61	396	511	29.42	499	453
34	16.61	295	596	23.58	402	519	30.43	508	459
35	17.26	299	608	24.63	408	527	31.96	515	466
36	17.95	304	615	25.50	411	536	32.67	523	473
37	18.45	310	622	26.58	417	543	33.94	530	479
38	19.80	316	630	27.61	429	551	35.10	536	486
39	20.92	322	639	28.62	434	579	36.70	543	492
40	21.42	329	648	29.31	438	586	37.99	551	498

For heads greater than the tables, see page 86.

TABLES

Giving horse power, cubic feet of water used and number of revolutions per minute of 12, 14 and 16 in. wheels under heads from 41 to 80 feet.

Head.	12 IN. WHEEL.			14 IN. WHEEL.			16 IN. WHEEL.		
	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.
41	22.96	336	658	30.40	444	593	38.63	557	504
42	23.87	343	665	31.32	449	601	39.72	561	509
43	24.82	348	674	32.40	454	607	41.30	570	515
44	25.60	352	682	33.20	460	613	42.23	577	521
45	26.41	356	690	35.01	464	620	43.56	584	528
46	27.38	360	698	36.50	469	626	44.78	592	535
47	28.10	365	706	38.11	474	633	46.21	597	541
48	29.11	371	714	39.12	478	640	47.31	603	548
49	29.90	377	720	40.50	482	646	48.58	610	555
50	31.65	382	727	41.00	487	652	49.87	617	561
51	32.19	388	735	42.80	491	658	51.17	623	567
52	33.50	394	743	43.90	495	664	52.44	627	573
53	35.61	399	750	44.87	500	670	53.75	633	579
54	36.41	404	757	46.11	504	676	55.31	638	586
55	38.11	410	764	47.52	509	682	56.42	645	593
56	39.19	416	771	48.75	513	688	57.93	651	599
57	40.33	422	778	50.25	518	694	59.68	656	607
58	40.91	428	785	51.45	523	702	60.82	662	614
59	41.51	433	792	52.61	528	706	62.14	669	620
60	42.66	438	799	53.62	533	712	64.00	674	626
61	43.67	444	806	55.00	535	718	66.18	680	632
62	44.82	449	813	56.33	538	724	68.93	681	638
63	46.00	454	819	57.61	543	730	70.32	693	644
64	47.41	460	826	58.90	547	735	71.89	696	650
65	48.62	464	832	60.10	552	740	73.25	701	657
66	50.12	469	838	62.30	556	746	74.73	706	662
67	51.36	474	845	63.91	561	751	76.25	711	668
68	52.51	478	851	65.00	565	757	77.89	716	675
69	53.27	482	858	66.20	570	762	79.24	720	681
70	55.11	487	864	67.31	574	768	80.25	726	688
71	56.41	491	870	68.52	577	773	82.26	731	695
72	57.62	495	876	70.20	579	778	83.74	730	701
73	58.97	500	882	72.41	582	783	85.23	742	707
74	60.11	504	888	73.21	585	788	86.84	748	712
75	62.17	509	895	74.82	588	793	88.42	753	718
76	63.90	513	902	76.00	593	798	90.15	759	724
77	65.11	518	908	77.43	598	803	91.58	765	731
78	66.13	523	914	79.19	604	808	93.18	771	738
79	67.31	528	920	80.51	608	813	94.65	775	745
80	68.51	533	926	82.13	616	818	96.31	779	752

For heads greater than the tables, see page 86.

TABLES

Giving horse power, cubic feet of water used and number of revolutions per minute of 18, 21 and 24 in. wheels under heads from 1 to 40 feet.

Head.	18 IN. WHEEL.			21 IN. WHEEL.			24 IN. WHEEL.		
	Horse Power.	Cubic Feet.	Rev. per Min	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.
1	.21	129	65	.36	169	60	.44	182	55
2	.54	156	97	.82	221	85	.97	289	75
3	.99	184	119	1.41	273	105	1.89	346	90
4	1.51	216	138	2.11	313	121	2.73	397	105
5	2.19	244	153	2.91	350	136	3.82	441	115
6	2.84	280	167	3.68	380	149	4.84	480	126
7	3.63	305	180	4.79	412	162	6.18	520	136
8	4.30	221	192	5.78	443	174	7.51	555	147
9	4.99	341	204	6.92	468	184	8.96	579	156
10	5.96	360	215	8.10	495	194	10.57	630	164
11	6.87	379	228	9.21	513	204	12.00	651	172
12	7.69	416	237	10.83	540	213	13.72	683	179
13	8.78	443	247	11.96	565	221	15.71	709	187
14	9.83	450	258	13.40	586	230	17.31	735	193
15	10.96	466	267	15.00	607	238	19.23	760	200
16	11.94	482	276	16.82	624	245	20.99	785	206
17	13.00	498	282	17.90	646	253	23.01	820	213
18	14.86	512	293	19.19	664	260	25.18	833	219
19	16.21	526	302	20.92	682	267	27.25	854	225
20	17.83	540	311	22 87	700	274	29.46	879	230
21	18.97	551	318	24.96	717	281	31.71	900	236
22	19.82	562	325	26.01	734	288	33.97	919	241
23	20.90	575	332	27.87	750	294	36.64	940	247
24	22.06	587	339	29.82	767	301	38.84	960	252
25	23.94	599	345	31.81	783	307	41.51	980	257
26	24.88	611	351	33.62	788	313	43.68	1000	262
27	25.97	622	357	35.31	813	319	46.31	1022	267
28	27.47	632	363	37.80	828	324	48.92	1041	272
29	28.81	642	370	39.47	843	330	51.48	1059	277
30	30.90	654	377	41.62	858	336	53.96	1077	281
31	32.15	665	383	43.83	872	341	56.83	1095	286
32	33.88	674	389	45.72	886	347	59.73	1113	290
33	35.00	684	395	47.83	900	352	62.80	1129	295
34	36.73	694	401	49.97	914	358	65.00	1142	299
35	38.42	704	406	52.82	927	363	67.96	1162	303
36	39.97	714	412	54.74	940	368	70.89	1172	308
37	41.91	723	417	56.97	953	373	73.98	1215	312
38	43.65	732	423	58.93	966	378	76.99	1252	316
39	45.15	741	428	61.47	978	383	79.95	1270	320
40	47.01	750	434	63.80	991	388	83.13	1288	324

For heads greater than the tables, see page 86.

TABLES

Giving horse power, cubic feet of water used and number of revolutions per minute of 27, 30 and 36 in. wheels under heads from 1 to 40 feet.

Head.	27 IN. WHEEL.			30 IN. WHEEL.			36 IN. WHEEL.		
	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet	Rev.	Horse Power.	Cubic Feet	Rev.
1	.51	211	50	.56	318	45	1.08	520	40
2	1.37	389	65	1.55	462	60	2.29	670	50
3	2.29	454	79	2.86	567	73	4.04	820	60
4	3.45	526	94	4.20	652	84	6.11	948	69
5	4.77	589	107	5.84	760	94	8.45	1000	78
6	6.50	646	116	7.64	800	102	11.05	1157	89
7	7.89	699	125	9.60	865	110	13.94	1241	95
8	9.60	748	133	11.62	926	118	16.92	1328	102
9	11.44	794	141	13.95	982	124	20.13	1408	108
10	13.33	836	148	16.32	1036	131	23.56	1488	113
11	15.39	879	155	18.81	1087	137	27.14	1561	118
12	17.69	918	162	21.43	1136	144	30.43	1629	123
13	19.76	956	168	24.15	1183	150	34.82	1698	127
14	21.96	993	174	26.97	1229	156	38.89	1763	132
15	24.53	1028	180	29.89	1270	162	43.10	1825	136
16	26.68	1062	186	32.92	1310	167	47.47	1886	140
17	29.52	1095	192	36.08	1355	172	51.94	1944	144
18	32.02	1127	197	39.28	1394	176	56.59	2001	148
19	34.60	1158	202	42.58	1431	181	61.36	2056	152
20	37.54	1188	207	45.99	1470	186	66.26	2110	156
21	40.25	1218	212	49.46	1506	190	71.26	2163	159
22	43.30	1247	217	53.03	1542	194	76.41	2214	163
23	45.97	1275	222	56.69	1578	198	81.66	2264	166
24	48.99	1303	226	60.41	1611	202	87.02	2313	170
25	51.96	1330	231	64.20	1644	206	92.50	2361	173
26	55.34	1356	235	68.10	1677	210	98.10	2408	178
27	58.59	1383	240	72.06	1709	214	103.8	2455	180
28	61.74	1408	244	76.10	1741	218	109.6	2500	183
29	64.98	1433	248	80.21	1772	220	115.5	2545	186
30	68.52	1458	252	84.37	1802	225	121.6	2590	189
31	71.93	1482	256	88.62	1832	229	127.6	2632	192
32	75.59	1506	260	92.93	1862	233	133.8	2674	195
33	78.87	1529	264	97.29	1890	236	140.5	2717	198
34	82.77	1553	268	101.7	1918	240	146.9	2758	201
35	86.34	1576	272	106.2	1947	243	153.4	2800	203
36	89.95	1598	276	110.8	1975	246	159.7	2838	206
37	93.79	1620	280	115.5	2001	250	166.4	2867	209
38	97.50	1642	284	120.2	2028	253	173.2	2916	212
39	101.38	1664	287	125.0	2055	256	180.2	2954	214
40	105.49	1685	290	130.0	2079	260	187.0	2990	216

For heads greater than the tables, see page 86.

TABLES

Giving horse power, cubic feet of water used and number of revolutions per minute of 42, 48 and 54 in. wheels under heads from 1 to 40 feet.

Head.	42 IN. WHEEL.			48 IN. WHEEL.			54 IN. WHEEL.		
	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.	Horse Power.	Cubic Feet.	Rev.
1	1.7	690	33	2.0	970	30	3.8	1199	27
2	3.0	952	43	3.9	1241	40	5.2	1552	36
3	5.6	1169	53	7.2	1512	48	9.3	1905	43
4	8.6	1352	62	10.9	1748	55	13.9	2203	50
5	12.0	1512	71	15.4	1956	62	20.8	2447	55
6	15.7	1658	78	20.1	2128	67	25.9	2702	60
7	19.8	1792	83	25.4	2290	72	32.5	2919	64
8	24.0	1915	89	31.0	2456	76	38.5	3121	68
9	28.7	2032	93	37.0	2608	80	47.1	3314	71
10	33.6	2144	97	43.7	2748	84	55.2	3492	74
11	38.7	2249	101	50.1	2883	88	63.5	3665	78
12	44.1	2349	105	57.2	3010	91	72.2	3830	81
13	49.7	2445	109	64.9	3133	95	81.3	3983	84
14	55.5	2538	113	72.1	3252	98	91.8	4138	87
15	61.6	2628	117	80.3	3366	101	100.5	4285	90
16	67.9	2715	120	87.9	3476	104	110 8	4426	93
17	74.2	2798	124	96.1	3584	107	121.3	4562	95
18	80.8	2880	127	104.8	3688	110	132.1	4798	98
19	87.7	2960	130	113.6	3788	113	143.3	4826	101
20	94.7	3037	134	122.7	3886	116	154.7	4951	103
21	101.8	3111	137	131.9	3982	119	166.5	5074	106
22	109.2	3186	140	141.5	4075	121	178.5	5194	108
23	116.7	3256	143	151.2	4167	124	190 7	5311	110
24	124.4	3327	146	161.2	4257	127	203.2	5426	112
25	132.1	3395	148	171.4	4346	129	216.0	5538	115
26	140.2	3463	151	181.9	4431	132	229.1	5649	117
27	148.3	3528	154	192.3	4515	134	242.4	5757	119
28	156.7	3593	157	202.8	4598	136	255.9	5862	121
29	165.1	3658	159	213.9	4679	139	269.8	5967	123
30	173.7	3721	162	224.9	4760	141	283.8	6069	125
31	182.4	3783	165	236.1	4838	143	299.2	6170	127
32	191.3	3843	167	247.9	4916	,145	312.5	6268	129
33	200.4	3904	170	259.5	4992	148	327.4	6366	131
34	209.6	3962	172	271.4	5068	150	342.2	6462	133
35	218.9	4020	175	283.5	5143	152	357.4	6557	135
36	228.3	4077	178	295.2	5214	154	372.8	6650	137
37	237.8	4133	182	307.9	5287	158	388.5	6742	139
38	247.6	4199	184	320.8	5357	160	404.3	6833	141
39	257.4	4244	186	333.0	5426	162	420.1	6922	143
40	267.3	4292	189	352.4	5496	164	436.8	7011	145

For heads greater than the tables, see page 86.

Directions for Setting Wheels.

The "Perfection" is very easy to set. In brief, the directions are simply these: **Set the wheel level and give lots of room for water to get to wheel, and to get away from it.** The following cuts clearly show many ways of setting, and any man who has the least judgment can set it to suit any location. We give the following general directions, which should be very carefully followed:

1. The cross section of the canal or head-race should contain at least one square foot in area for each forty cubic feet used per minute by the mill. Example: Your mill has, say, a twenty-four inch wheel under eleven feet head, using six hundred and fifty cubic feet per minute, then your head-race should not have less area than sixteen square feet, or six feet wide by two-and-one-half feet deep, or its equivalent. As much larger than this so much the better. You can't get it too big. This, however, will give a flow of current less than one foot per second, which it should never exceed. Your forebay should have one square foot for each fifty-five cubic feet used per minute.

2. The wheel pit should be dug down to such a depth so that after the platform the wheel is to set on is put in the level of standing tail-water, should be the depth for each wheel, as given in column *D* on pages 32 and 43. If the depth is six or eight inches deeper it makes no difference, but if possible it should never be more than two inches less. The pit should be dug the same depth for some distance down the tail-race in order to give plenty of room for water to get away, and then gradually sloped off to regular tail-race bottom.

3. The "Perfection" discharges its water all around on the bottom of the curb, so there must be allowed as much room as possible on the sides, so that the water can get away freely after doing its work.

4. Put down ties or bed-timbers on the tail-race bottom, and on these spike plank not less than two inches thick (the thicker the better). Make this platform as solid and as level as possible. Do this job well, for under water it will last forever. The wheel sets on this platform.

If the bottom is rock no platform is needed. Level off the rock nicely and set the wheel on it.

5. The wheel sets by three columns on a flat bed of plate. The bed-plate may be spiked or screwed to the planking after the wheel is set level.

6. **NOTE THIS: Set the wheel perfectly level, and make it so it can't get out of level.** Try the wheel with a good spirit-level where it is turned for the dome. Double wheels on the dome.

Caution:—Don't depend altogether on the wheel coming level because you have leveled the planking, but level the curb. This is very important and easy to do.

7. Examine the wood-step to see if it has dried out in shipment and standing around, and got loose. If so, wet it until it swells tight. Also, see if step is not knocked out of truth by rough handling in hauling. If so, adjust it by the screws so that wheel don't rub side of case, but clears all around.

8. The gate-box may be bolted to square wood penstock, wood spout or iron pipe. Don't make the pipe or spout too small for the sake of saving a dollar or two. It is poor economy. Don't lead the water into wheel through narrow openings. Let everything here be liberal, and always have as large a body of water as close as possible to the gate-box. The cuts give you a good idea. The following are the smallest inside diameters for pipes for Standard Wheels:

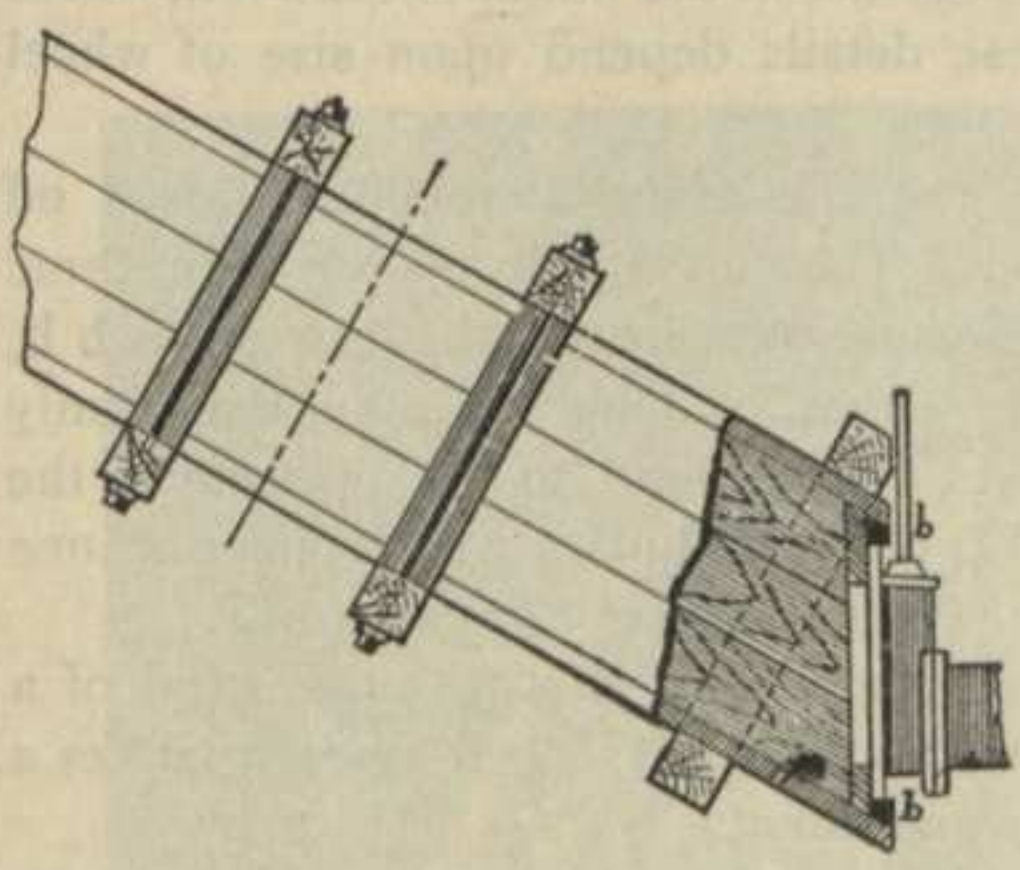
Diameter of wheel	6	8	10	12	14	16	18	21	24	27	30	36	42	48
Inside diameter of pipe	10	12	14	16	20	24	24	30	30	36	36	48	54	60

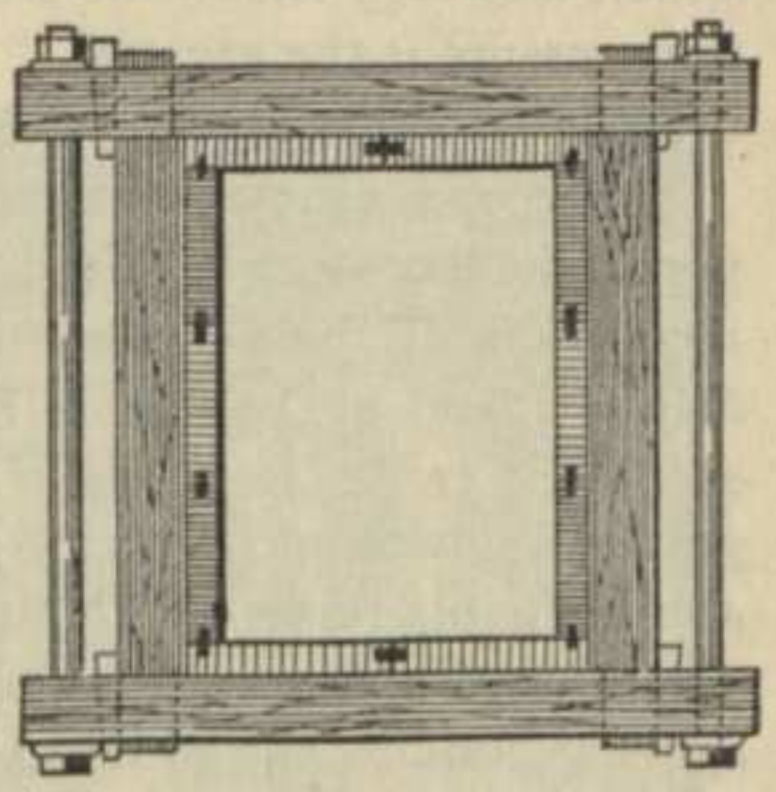
9. The rod for hoisting the gate should be of wood two, three, four or five inches square. It is fastened at one end to gate-rod, at other may be operated by rack and pinion, or lever, etc. The rods for operating gate may be run to any part of mill by bevel gears. For larger wheels we furnish a screw.

10. With these directions, and a careful study of the many cuts we give, any man, whether he is a skilled mechanic or not, should be able to set the "Perfection" wheel. When wheel is all set and pipe, or forebay, or penstock is full of water, try turning wheel around by hand. It should turn easy. If so, draw the gate and it will "tickle you all to pieces" by the magnificent manner it performs.

One very important thing, and without which the wheel will not do its best, is to have all the shafting perfectly true and in line, and run easy in the boxes. The gearing must also be perfectly arranged. It takes very little to take off from 25 to 30 per cent. But with ordinary care there will be no trouble.

We greatly prefer to always have a good, careful millwright to set wheels and put up machinery, but we know there are some places where these can not be had. Then we say: Don't be afraid to pitch in and set the wheel yourself, for you will come out all right if you only set it level and get lots of water room to it and from it, and don't have the shafting out of line and binding. Some of our wheels doing the best to-day were set up and geared by farmers' boys who never saw a turbine in their life before they saw a "Perfection."





Cheap and Good.

A very cheap, and, at the same time, one of the very best ways of bringing the water to the "Perfection" wheel, is by means of the square wooden spout, as represented in the above cut. Hundreds of our wheels have been set in this way in preference to any other manner.

In some parts of the country, especially in the West and South, millwrights are exceedingly scarce. The spout here shown can be built by any man who has sufficient skill to use the ordinary carpenter's tools, and it is for such the following explanation is given, as any millwright can make such a spout without any hints from us.

The *inside* dimensions of the spout should be 6 inches larger than the *outside* measurements of flange of gate box given in columns **F** and **H** on pages 32 and 43; that is, three inches all around. The sides of the spout should be made of 2½ or 3 inch plank, preferably the latter; and each side should be made up of two, three or more planks, carefully put together with planed joints. Each corner and each joint should be grooved, and a tongue put on to make a water-tight joint, as shown in the sectional view on the right.

The spout is securely clamped together, with frames made of 6x6 inch timber, except under very high heads, when the lower frames should be 8x8 inches. The frames are made in the following manner: The ends of the two side pieces are tenoned to fit into mortises in the top and bottom pieces. The mortises should be longer than the tenons are wide by one and one-half or two inches to give room for the wedges to enter, and by driving clamp the two sides of spout. The top and bottom pieces are clamped together by two bolts, which should be one inch in diameter. The frames should be placed on the spout sufficiently far

apart to prevent all springing of the sides of the spout when filled with water, and they should be closer together at the bottom of the fall, where the pressure is the greatest. These details depend upon size of wheel used and height of fall.

The end of spout, where the wheel is to be attached, is sawed off perpendicular to level of tail-water. The end is boarded up with three inch planking, held against the pressure outward by the iron strips **b b**, firmly spiked or bolted, to inside edges of spout or otherwise firmly secured. In this end a hole is cut to correspond to the opening of the gate-box, given in columns **G** and **I**, pages 32 and 43, and proper distance above the planking on which the wheel sets, given in column **J**.

Several of the cuts in this book show wheels set with this kind of a spout to conduct the water to them, and when it is well made it makes a cheap, durable and water-tight arrangement.

In fact, with a wheel set like this, any man who lives away out in the backwoods can buy a "Perfection" wheel and set it up himself, and have as good a power as those who live in a country surrounded by the best mechanics; and we think fully proves to any man that he can buy a "Perfection" wheel and set it, and save money over any other wheel in the country.

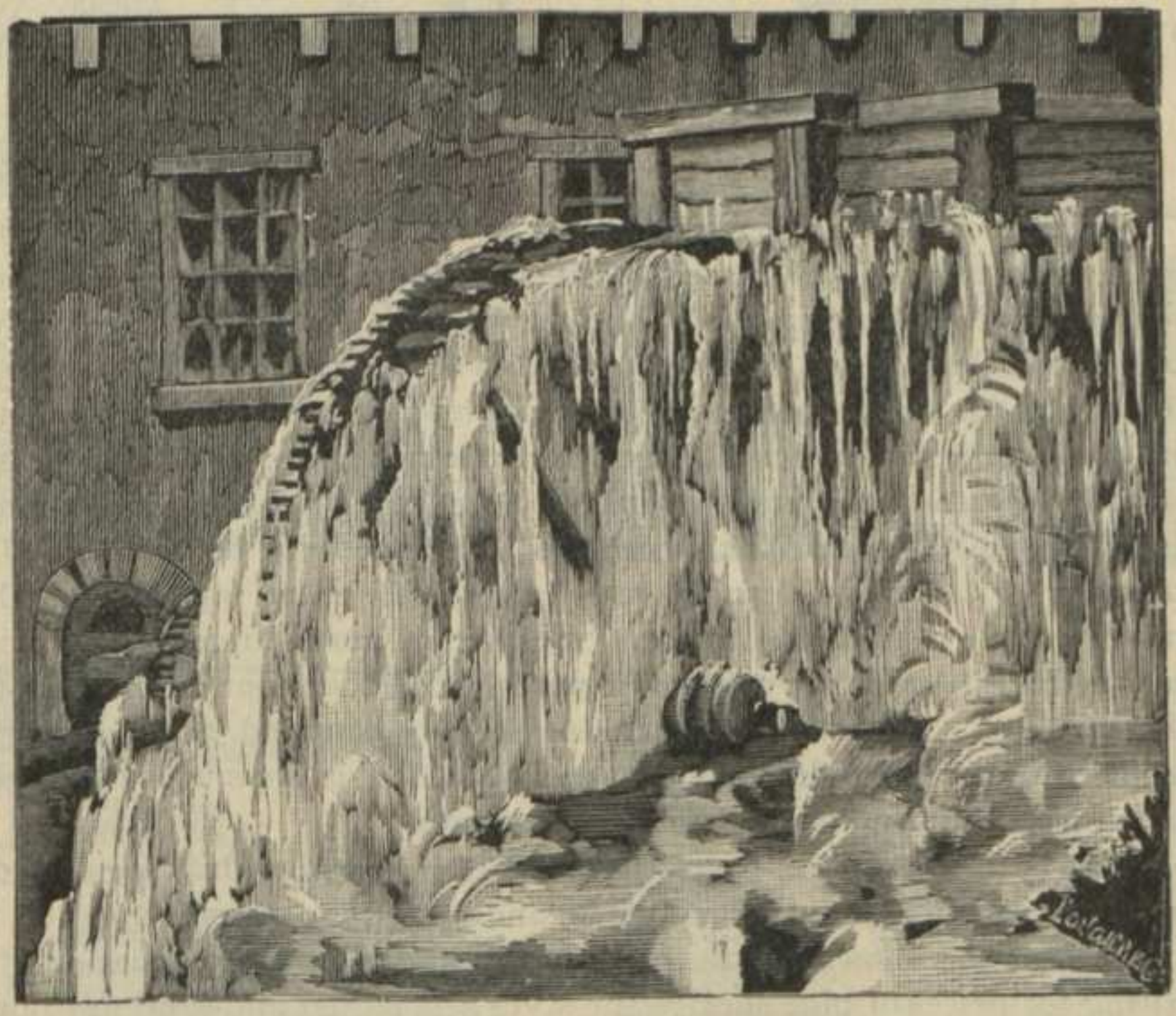
To prevent sagging the spout when put in should be firmly supported its entire length.

For New Countries.

We wish to impress upon those who may desire to improve powers in new countries where mechanics and machine shops are not to be had, that the "Perfection" is the only wheel that should be used. In the the first place, any ordinary man can set it up, and in the second place, it don't wear out or get out of order. We will guarantee them to any one for a fixed length of time if there should be any doubt in any one's mind upon this point.

We have sold great numbers for far-away sparsely settled regions, and every purchaser has found it just the wheel he needed, and we have never heard a single word of complaint of the wheel not filling in every particular all we claim for it.

Give it a trial. We ask no more, for it will surely please you, and you will become our living advertisement, far better than many bushels of printed matter.



"No Iron Wheel can Equal an Overshot."

This is an overshot. It has its winter clothes on. This is not a fancy picture, but was taken from an actual example. Nor was this wheel out of doors, but was housed. Many who read this book have seen just such looking wheels, and probably either now or in the past have owned them. A wheel always freezes up this way when the mill is crowded full of work, and not only is considerable money lost, but much dissatisfaction on the part of customers is caused by it.

The remedy is simple and easy enough. Get a "Perfection" water-wheel and throw the overshot away. As a work of nature a "Perfection" would probably not be so handsome as this Arctic scene, but as a matter of dollars and cents we think would be more satisfactory to the mill-owner.

We fully agree, in this case, with Mr. Old Fogy, that "No iron wheel can equal an overshot."

Good News! Mill-Owners Rejoice.

"Perfections" with Steel Pipes at no greater cost than other Wheels with Wood Penstock.

We are able to make so welcome an announcement to mill-owners for several reasons. In the first place the "Perfection" needs no outer iron case and that expense is at once saved. In the second place we are so situated that we can furnish steel pipes at a price never before so low. The reason for this is that Coatesville is a great steel manufacturing centre and we get the raw material direct from the mills, saving all freight and commissions and middlemen's profits. Steel being so much stronger and better to stand corrosion than iron, the pipes need not be so heavy to be stronger. Finally, we furnish such large numbers of pipes that it has warranted the getting up of special facilities to make them in quantities, and turning them out by wholesale we can turn them out cheap. As the fact that the "Perfection" can be so cheaply mounted in so elegant a manner brings us hundreds of customers, we find it pays us well to give our patrons the benefit of all these advantages.

The cuts on opposite page are made from working drawings of jobs we have furnished and will readily be understood by everybody.

Every style shown admits of modification to suit any situation. In writing for prices of pipe specify the style best suited and send us dimensions.

For **No. 1** give distance from where pipe enters forebay to centre of wheel measured horizontally, and distance from head-water to tail-water, and distance of upper end of pipe under head-water.

For **No. 3** give distance from under side of forebay to tail-water.

For **No. 4** give distance from front of forebay to centre of wheel. If forebay is shallow, pipe must enter bottom as in No. 5.

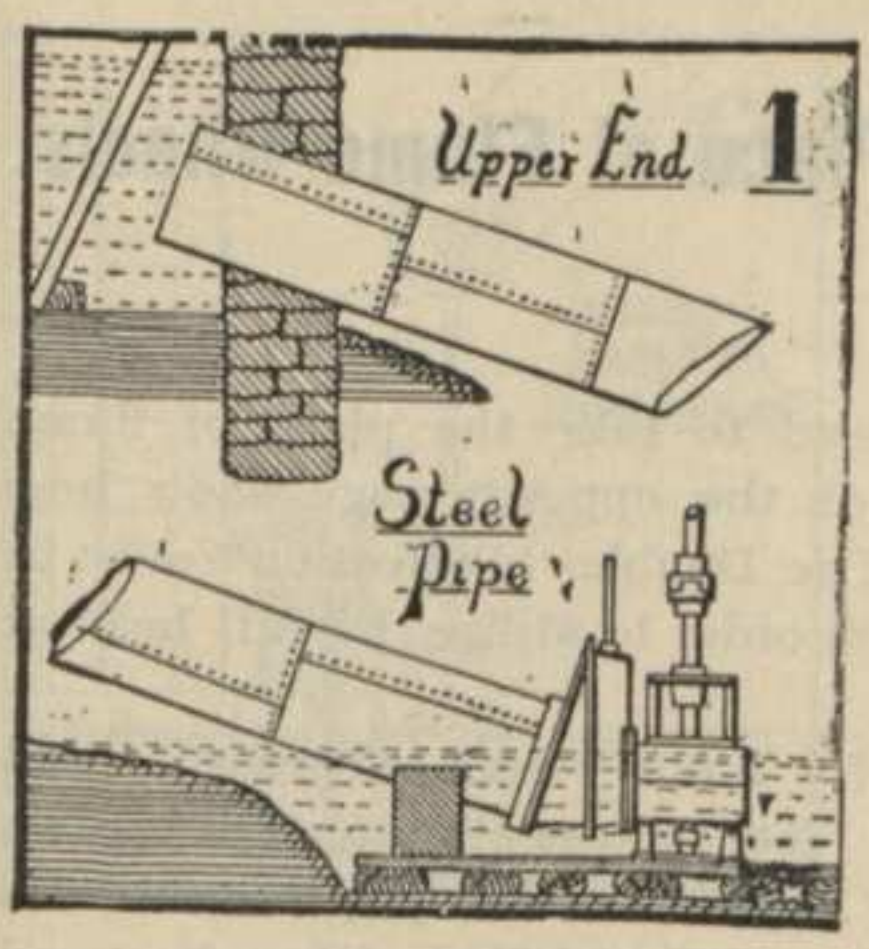
For **No. 5** give distance from centre of pipe where it enters bottom of forebay to centre of wheels and distance from bottom of forebay to tail-water.

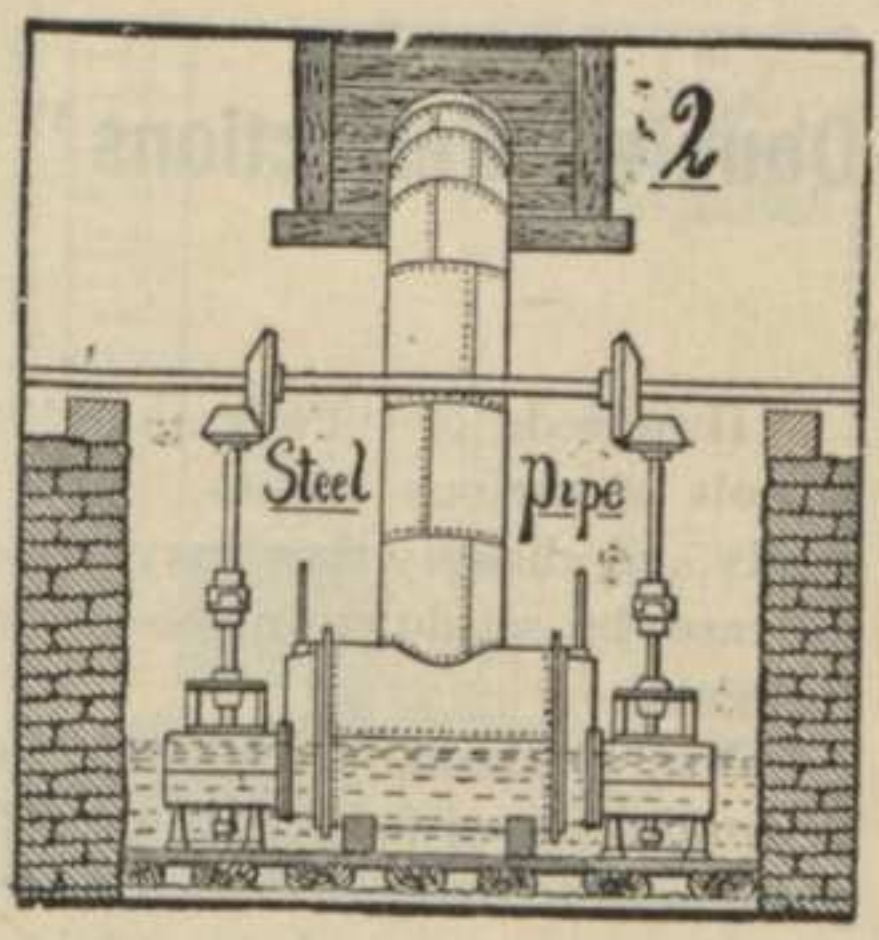
For **No. 5½** give the distances from bottom of forebay to the ground —from point under forebay opening to edge of pit wall—from edge of pit wall to centre of farthest wheel, and from top of wall to level of tail-water.

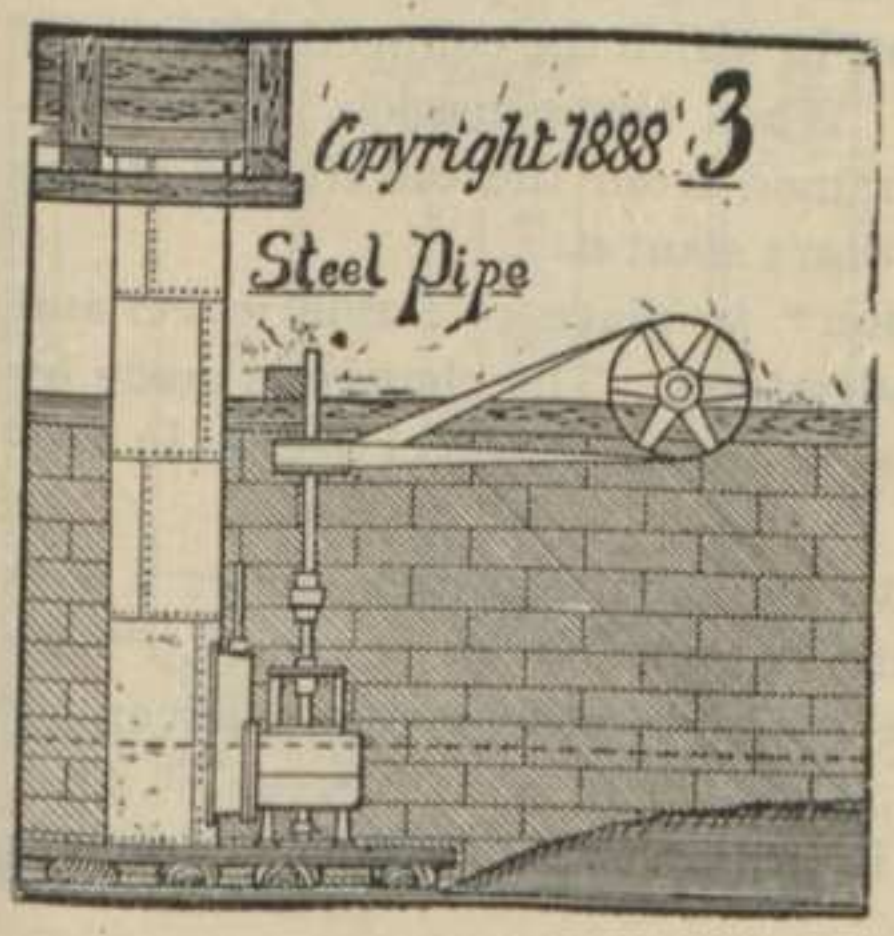
Of course, in all cases distance from head-water to tail-water (the head) must be given.

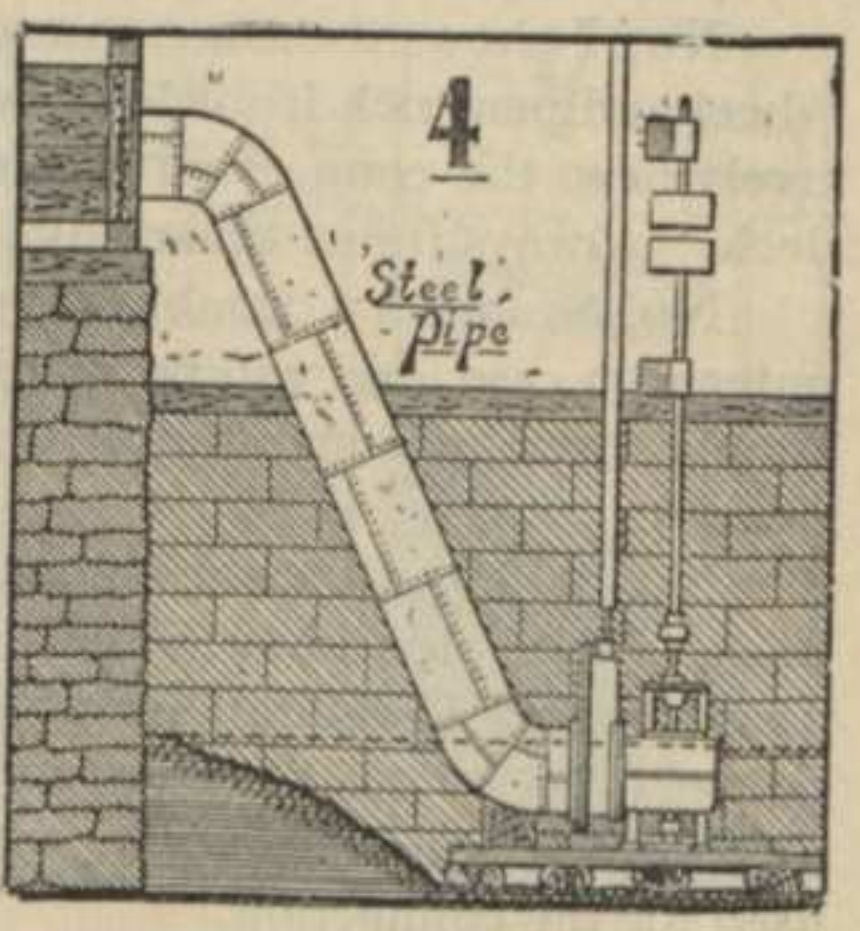
More than one-half of our orders for wheels include steel supply spouts. Where parties have their own timber and saw mills they probably can build wood spouts cheaper for the "Perfection."

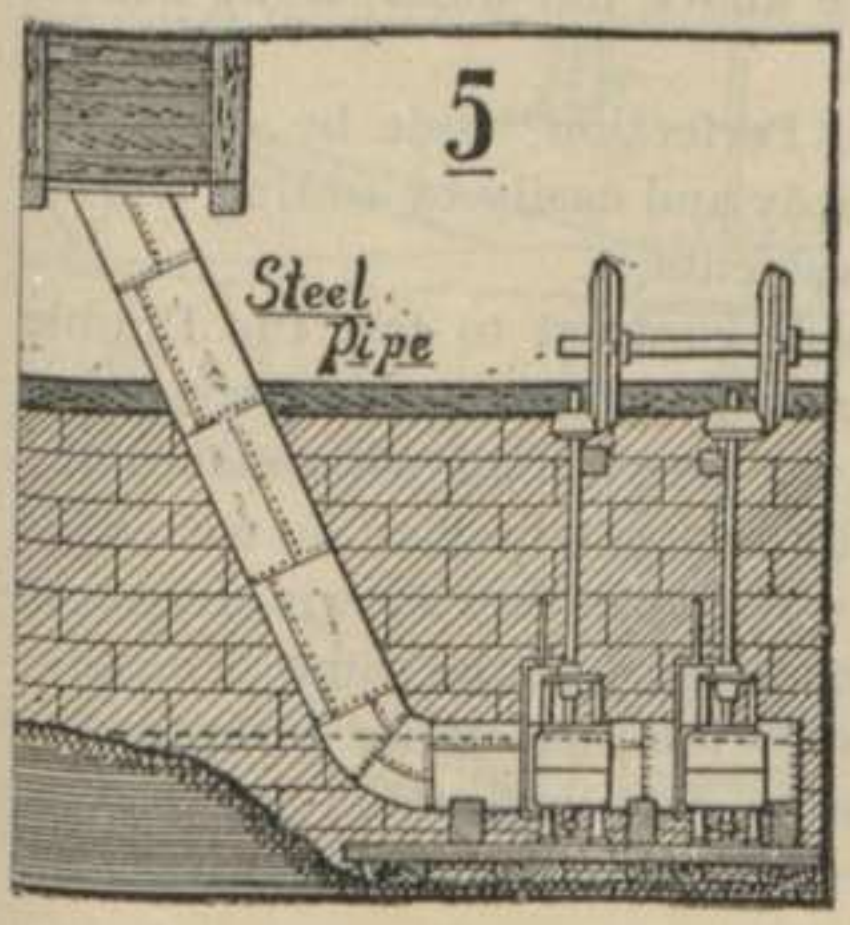
Standard "Perfections" can be set in this same manner.

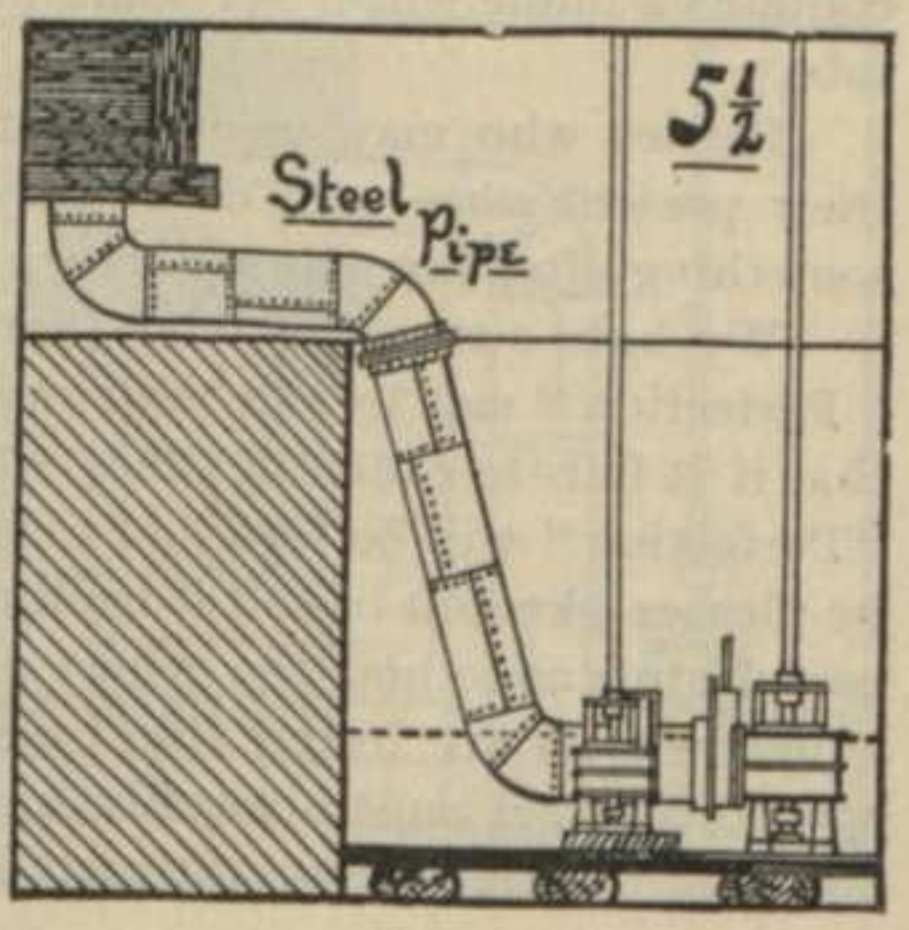

Upper End 1
Steel Pipe


2
Steel Pipe


Copyright 1888 3
Steel Pipe


4
Steel Pipe


5
Steel Pipe


5½
Steel Pipe

Double "Perfections" in Place of Flume Wheels.

Hundreds of "Perfections" are sold to take the place of flume wheels of various makes. The cuts on the opposite page show how easily and cheaply they may be set. The Double "Perfection" must in all cases be set down in the tail-water in order to utilize the full head at full gate.

No. 6 shows a wheel in place of a flume wheel, where a decked penstock is used for the flume wheel. To set the "Perfection" in its place, and to bring its centre directly under the old upright shaft, the deck is cut away, and the "Perfection," being supplied with a short and inexpensive piece of pipe, is bolted to the upright of penstock.

No. 7 shows the same arrangement, in which the connection between wheel and penstock is made of wood. When the penstock is comparatively new, the connection is usually framed from the old timber of the deck. Always frame square like this, don't slant it.

No. 8 shows a Double "Perfection" in place of flume wheel and outer iron case, and will be readily understood. The change is made by simply inserting a short piece of pipe so as to throw wheel deeper in tail-water.

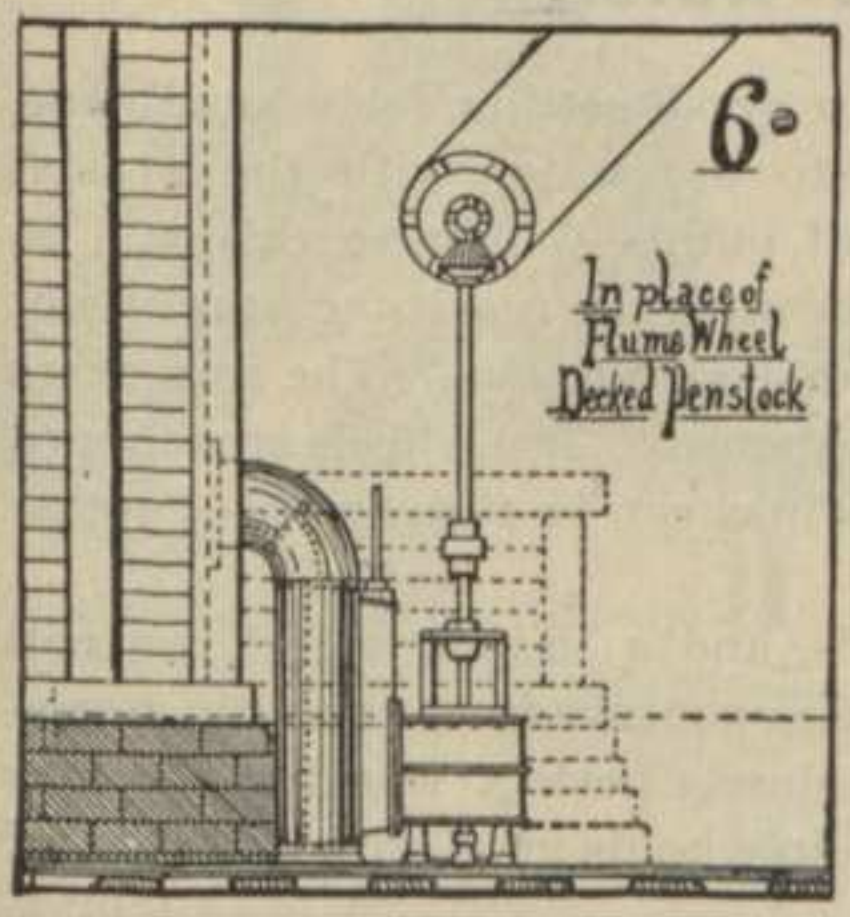
No. 9 shows a wood connection to an open penstock under a low head. The old flume wheel formerly drove burrs by gears. The "Perfection" is set further down the tail race and burrs are driven by belts.

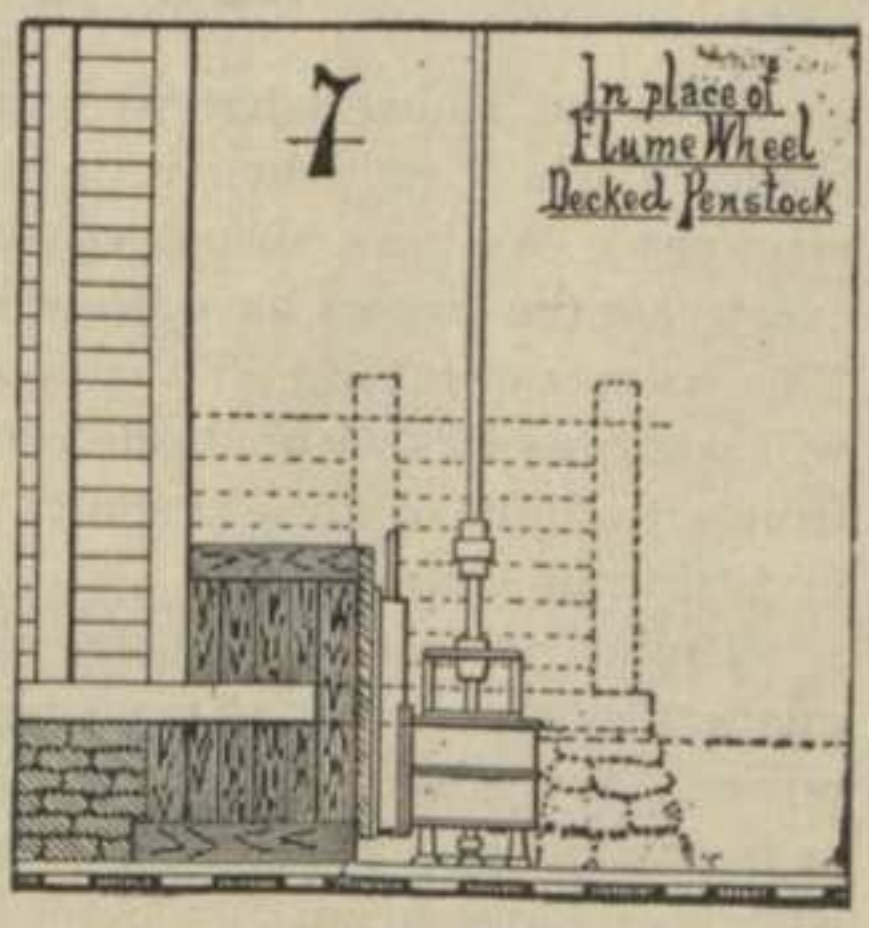
No 10 shows a similar setting, in which a short piece of pipe is used for the connection.

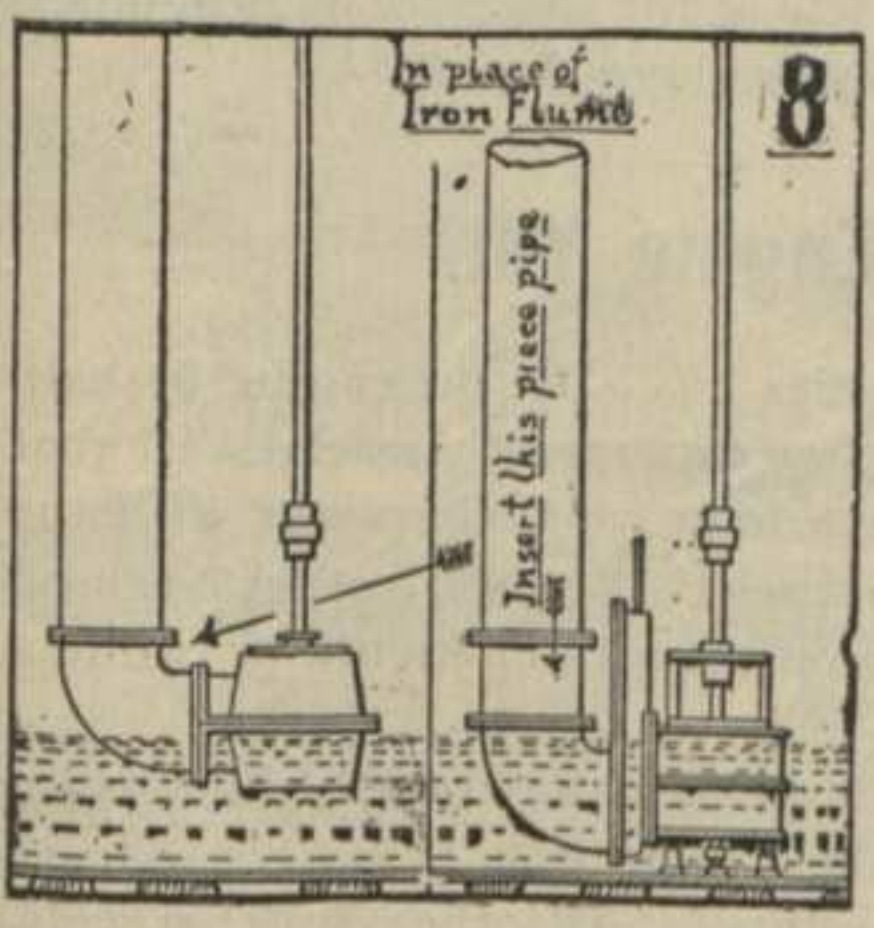
No. 11 shows Double "Perfection" attached to penstock, which contains a flume wheel set some distance above tail-water, using a draft tube.

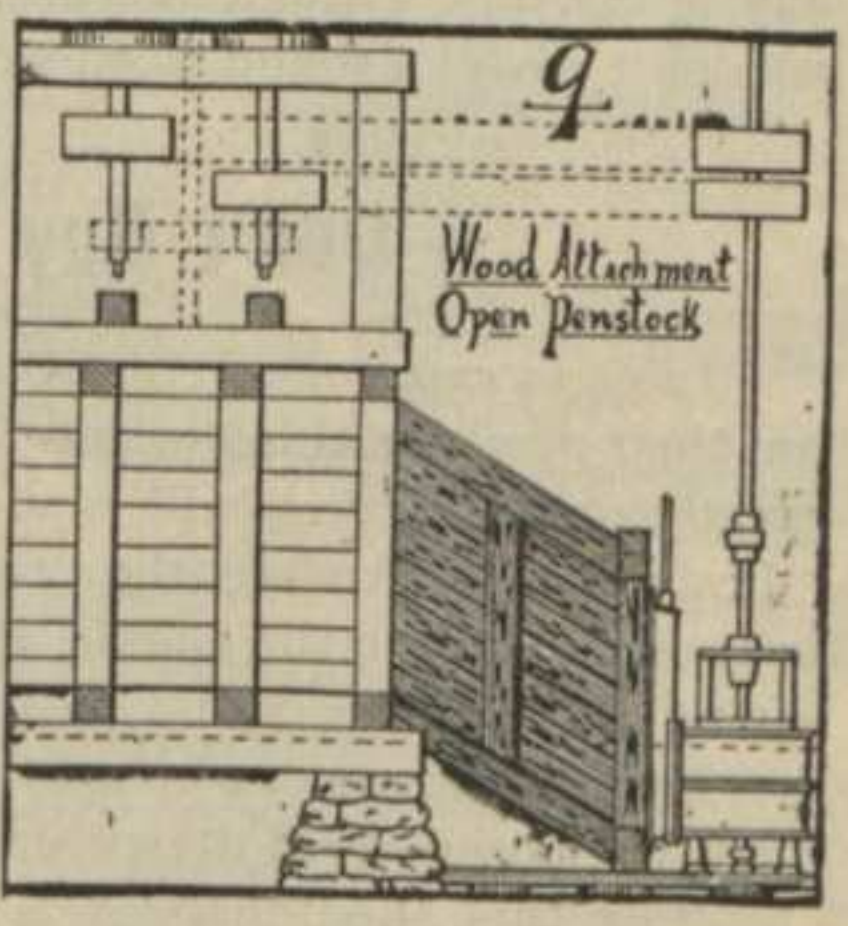
Parties who may want to test the "Perfection" side by side with their present wheel can do it very cheaply aud easily by setting wheels something after the manner shown in these cuts.

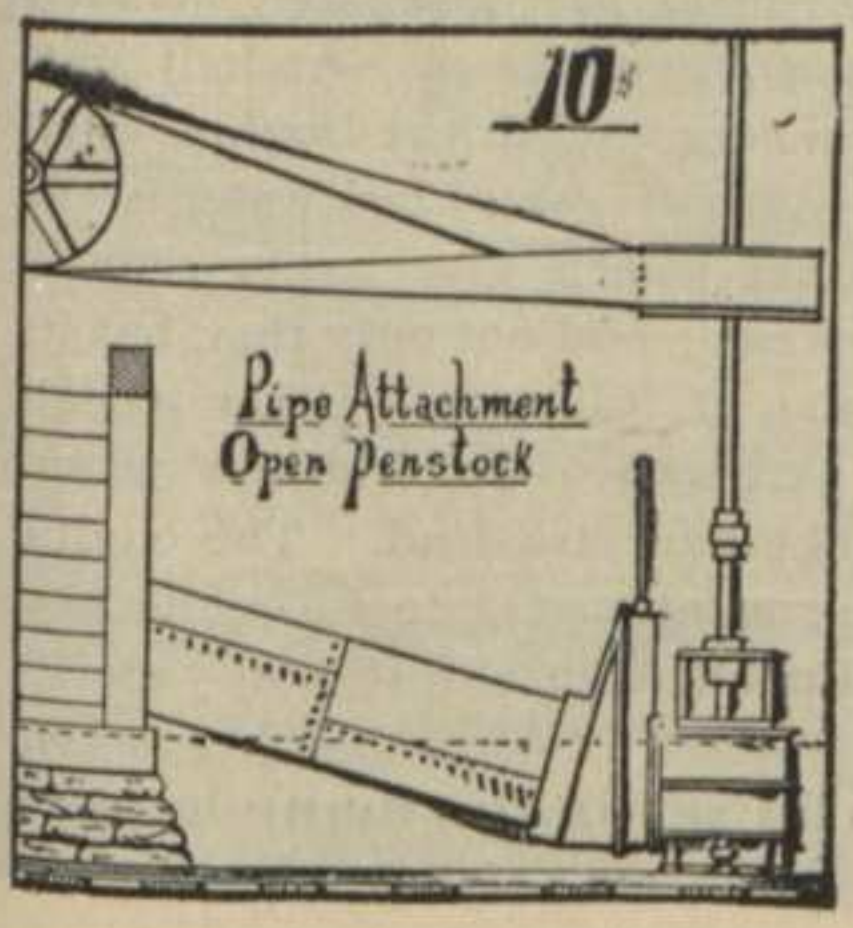
We have a standing offer that we will contract to test the Double "Perfection" side by side with any other water-wheel, upon the condition that if it fails to excel the other wheel (we care not of what make) the "Perfection" will be forfeited to the mill-owner, who may do with it as he pleases—keep it or sell it back to us. The cuts here shown give some useful hints as to how the wheel may be attached to the same penstock. When wheels are tested side by side with another under forfeiture, a special contract must always be made, so we can have some one to look after the "Perfection's" interests in the matter.

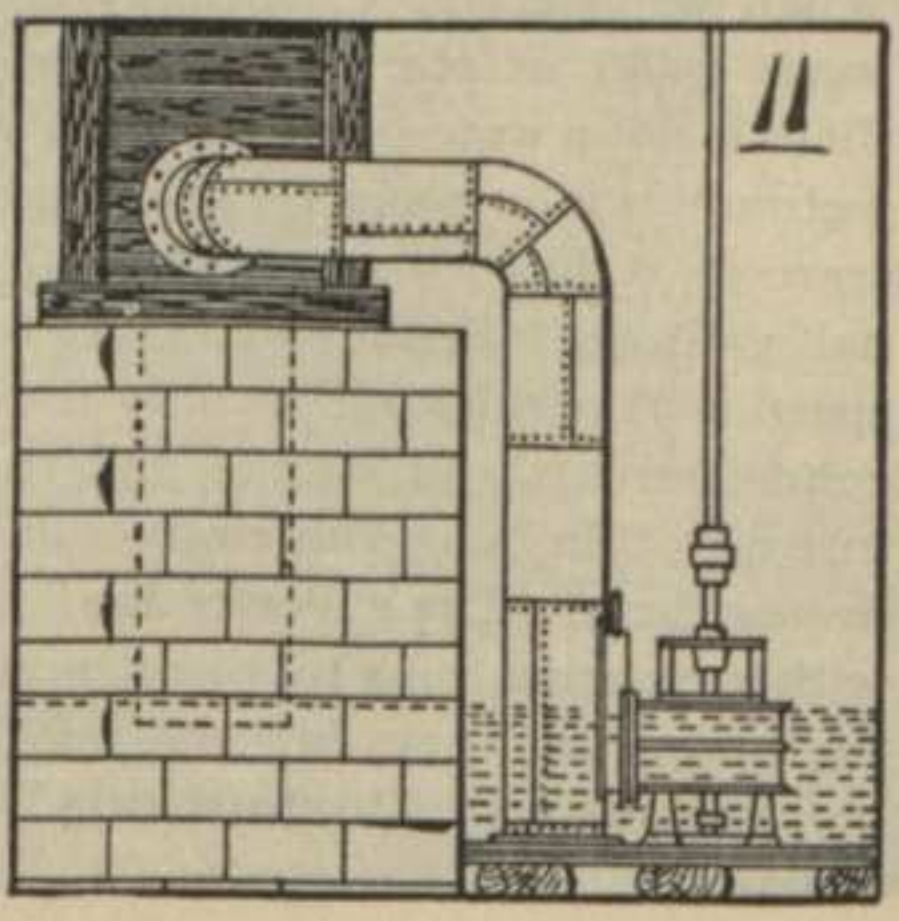

6
In place of
Flume Wheel
Decked Penstock


7
In place of
Flume Wheel
Decked Penstock


In place of
Iron Flume
8
Insert this piece pipe


9
Wood Attachment
Open Penstock


10
Pipe Attachment
Open Penstock


11

How to Save Water.

This cut shows what we consider a good setting for a small and cramped wheel pit when it is desired to use water with the utmost economy. We have furnished dozens of outfits similar to this, and in every case the owners have been delighted with the results accomplished. The manner of taking off the power is an excellent one. The spur gears will last for years without one cent for expense. The wheels are relieved from all weight of upright shaft. Any wheel can be thrown out of action by lifting up spur action.

Under 30 feet head, using two 21's, and a 16-inch wheel, we will guarantee 80 per cent. at any stage of gate openings from 25 to 216 horse-power. We think this is as near an absolutely perfect working of water as is possible to obtain. The same principle holds good with any sizes of wheels and any head.

In most cases but two wheels are used. The third can be added at any future time without expense. In view of the low price of steel pipes, we don't advise a round wood supply pipe as here shown.

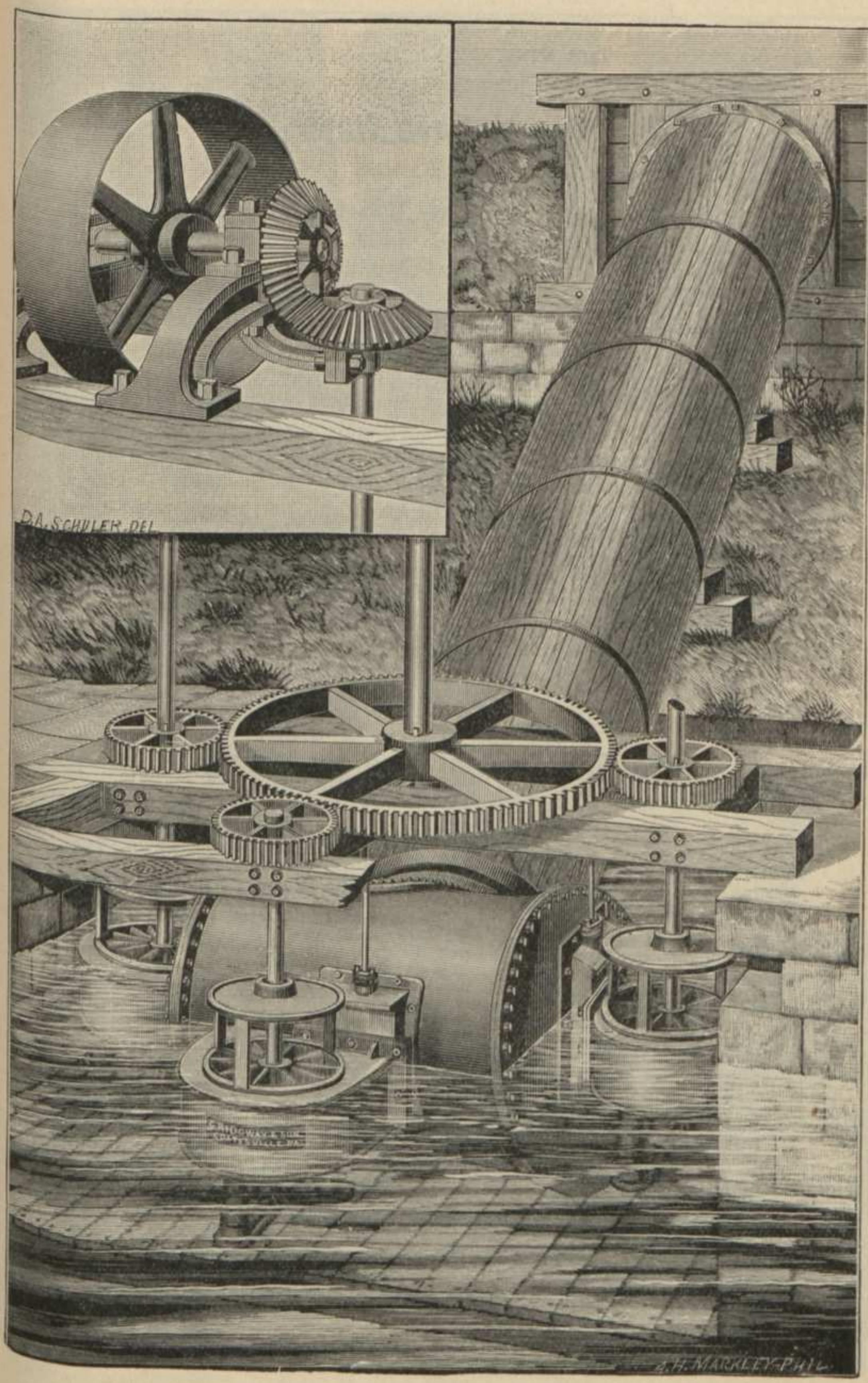
Don't Buy an Engine Yet.

In eight cases out of ten where parties buy a steam engine to help out their power in times of low water, they can save themselves all that great expense if they will first properly improve their power with the "Perfection." And in the other two cases if the "Perfection" is used in connection with the engine, it will save its cost in a month or two in a saving of fuel.

Many mill owners who contemplated being obliged to put in a steam plant have been saved the expense by the "Perfection."

Why this should be so is no mystery. All other water-wheels, without exception, give a good percentage only at or near full gate. When water is scarce, and they must be run at part gate, they *actually waste water at the very time they should economize it.* At half gate there is not a water-wheel but is a water waster. With the Double "Perfection" it is just exactly the opposite. At half gate, when water is the scarcest, it does its very best. Where other wheels give 40 per cent. at half gate, the "Perfection" gives 80 per cent.; and not only that, but its speed is as regular and exactly the same as at full gate. Other wheels connected with an engine, and run at part gate to suit the low water, instead of helping the engine, only make an extra load. The engine drives them. The "Perfection," when run at part gate, in connection with an engine, runs to speed, gives full percentage, and so really assists the engine and saves fuel.

Standard "Perfections" can be set in the manner here shown.


D.A. SCHULER. DEL.
A.H. MARKLEY. PHIL.

How to Save Water.

One, of most other wheels, leaks enough water and gives enough bother without multiplying it three times. The "Perfection" is so simple and its gate being so perfectly tight, there is no objection to stringing them out indefinitely. There are many advantages to be gained by subdividing the power between several wheels, and the best mills, in these days, so arrange their power.

The manner of taking off the power by quarter twist belt, as shown in this cut, is one we unhesitatingly recommend. We have many such transmissions in successful operation, using belts as wide as 20 inches. When it is desired to take the power on to a line shaft without the use of cog gear, of course the horizontal "Perfection" is the best. But as a horizontal wheel is much more expensive than the arrangement here shown, many prefer this.

It is our intention not to publish any testimonials in this edition of our circular, but as the writer of the following uses two wheels set very much like as shown here, we print this letter to show how our plans, when followed out, save water, and make poor powers into good ones.

We Can Delight You the Same.

GLADDENS, SOMERSET CO., PA.

C. RIDGWAY & SON.

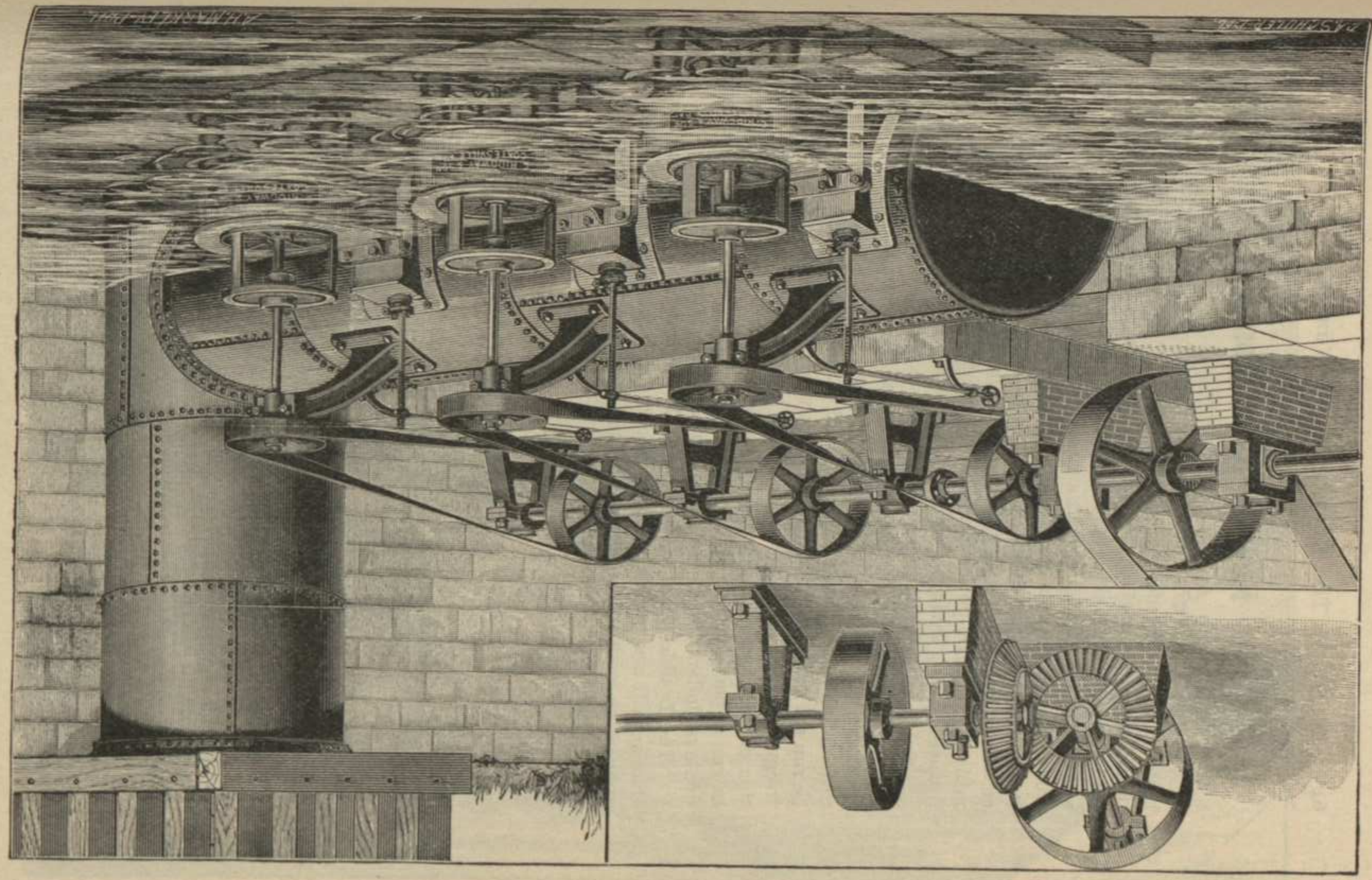
Dear Sirs: I am pleased to say (that is, voluntarily upon my part) that the wheels I bought from you this summer work *splendidly*. The water in this section of the country being extremely low since the latter part of July, and is still low yet, with your smallest wheel I am able to run all my machinery up to its full speed. This makes the natives marvel, and makes me acknowledge that the putting in of your wheels is the best improvement I ever made in my life, making or developing a second-class water-power into a first-class one. I do not claim any honor, as I simply carried out your plans, and all you claimed for your wheel came true. I have more power, better power, and less expensive power, and superior to anything I ever saw in my twenty-five years' experience with water-powers. The large wheel I have not run much yet, but it is a giant at full gate. I have it on to-day at half-gate, and it is doing fine.

My mill is the only one in all this country that is running full time with water. Two mills below me, who have Smith's "Success" wheels, can't run but a few hours per day. To make a long story short, it will pay any man expecting to put in a water-wheel, to come and see my mill, and see how much I do with so very little water. So simple and efficient, so marvellously successful: no noise, no splash, no patter of water; goes right along from morning till night without a hitch or balk, and when shut down, not a drop of leakage past the gates. But this is glory enough at this time, although I will at any time recommend your wheel and all the advice in your wheel book.

So far as the old fogyism goes of an overshot being superior to your wheel in economy in water, that is all humbug. I can run my place with either of your wheels with less water than any sixteen-feet overshot ever built to do the same work. Wishing you all the success you deserve, I am, yours,

M. L. TAUBER.

Standard "Perfections" can be set in the manner here shown.



How to Save Money.

The style of setting wheels, as shown on opposite page, is one of the best and one largely followed. Hundreds of "Perfections" have been so placed, from the smallest to the largest. The arrangement of pipe can be made much cheaper than here shown. The lower part, to which wheels are bolted, is extra long, with a view of bolting additional wheels to its front should occasion ever require. In an arrangement like this, using (say) 42 and 30-inch wheels under 25 feet head, 80 per cent. is obtained at all stages from 60 to 475 horse-power and the same regular speed. In mills where steam-power is used in connection with the water-power this feature means a saving of hundreds of dollars yearly in fuel.

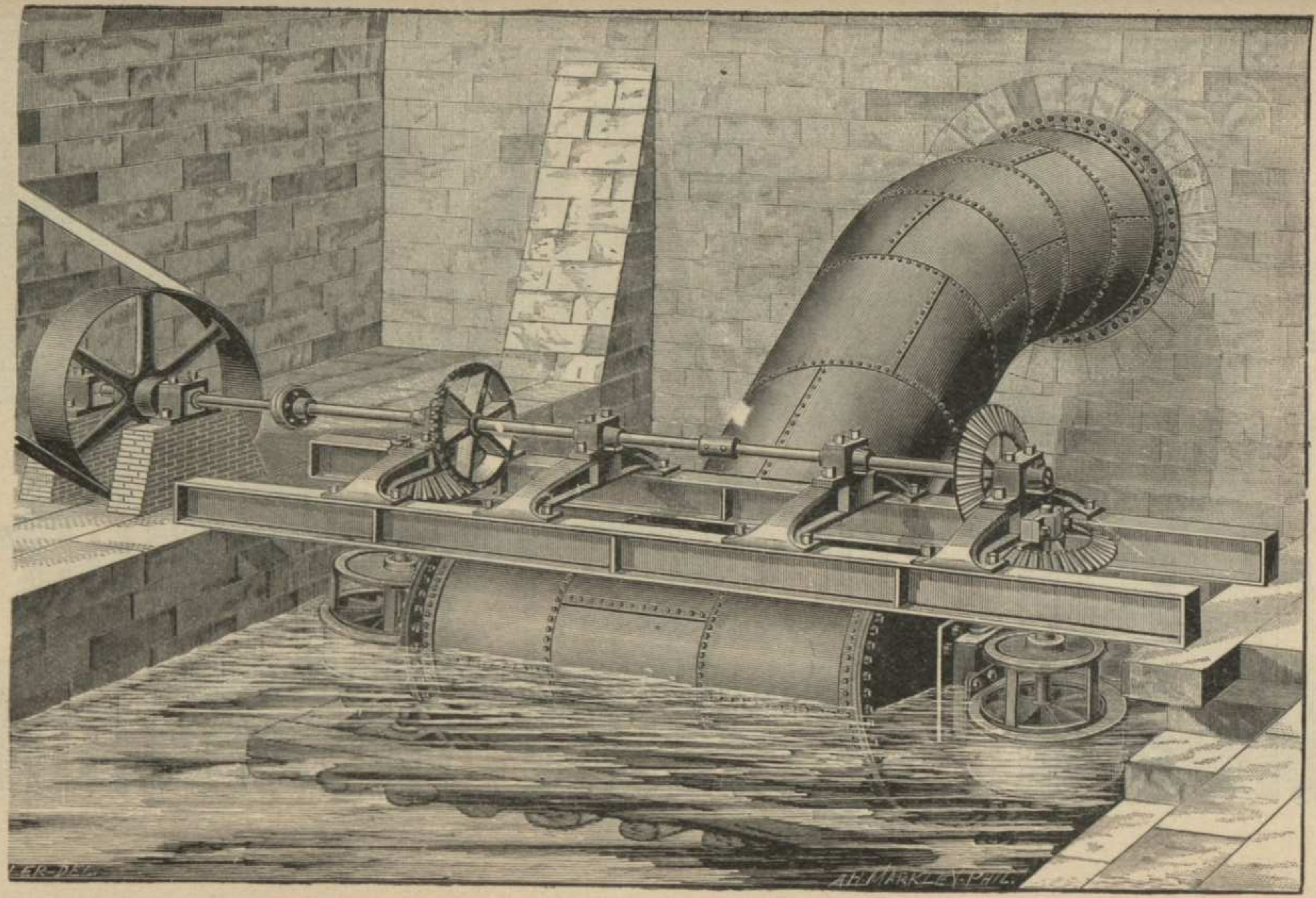
Suppose the mill required 450 horse-power to drive it. Part of the year, in the spring and fall, there is water in plenty to give this power, but in summer it falls away to 50 or 60 horse-power. If a water-wheel of the usual kind is used large enough to take the stream at its fullest, it must be run the greater part of the year at part gate, giving poor percentage and irregular speed. On the other hand, if a wheel to suit the average condition of the wheel is selected, part of the year, when water is low, it must be run at part gate at a loss, while at other times the mill-owner sees hundreds of dollars pouring over his dam while he is burning costly fuel.

The Double "Perfection" saves all this, and so great is the saving that we will contract with many concerns to furnish our wheels to run in connection with steam-power and take for our pay a certain percentage of what we save in the cost of fuel.

Our Fight.

The hardest opposition we have had to fight in the introduction of our matchless "Perfection" wheel has been the prejudice against it on account of its unfortunate resemblance to a class of wheels known years ago as "old scroll wheels," celebrated as "water suckers," "stream drinkers," etc. The magnificent performance of the "Perfection," however, has overcome this opposition, and the cry raised by our rivals that the wheel crowded to one side has been silenced by our offer of $1,000 cash to any one producing a "Perfection" wood toe showing side wear. With over 1,200 "Perfections" in daily operation in every State in the Union and in foreign countries, not in backwoods saw mills, but in the finest plants, would indicate to any intelligent man that the "Perfection" was all it is represented to be and that its merit must be more than ordinary to make so magnificent a success.

Standard "Perfections" can be set in the manner here shown.



How to Save Water and Gain Power.

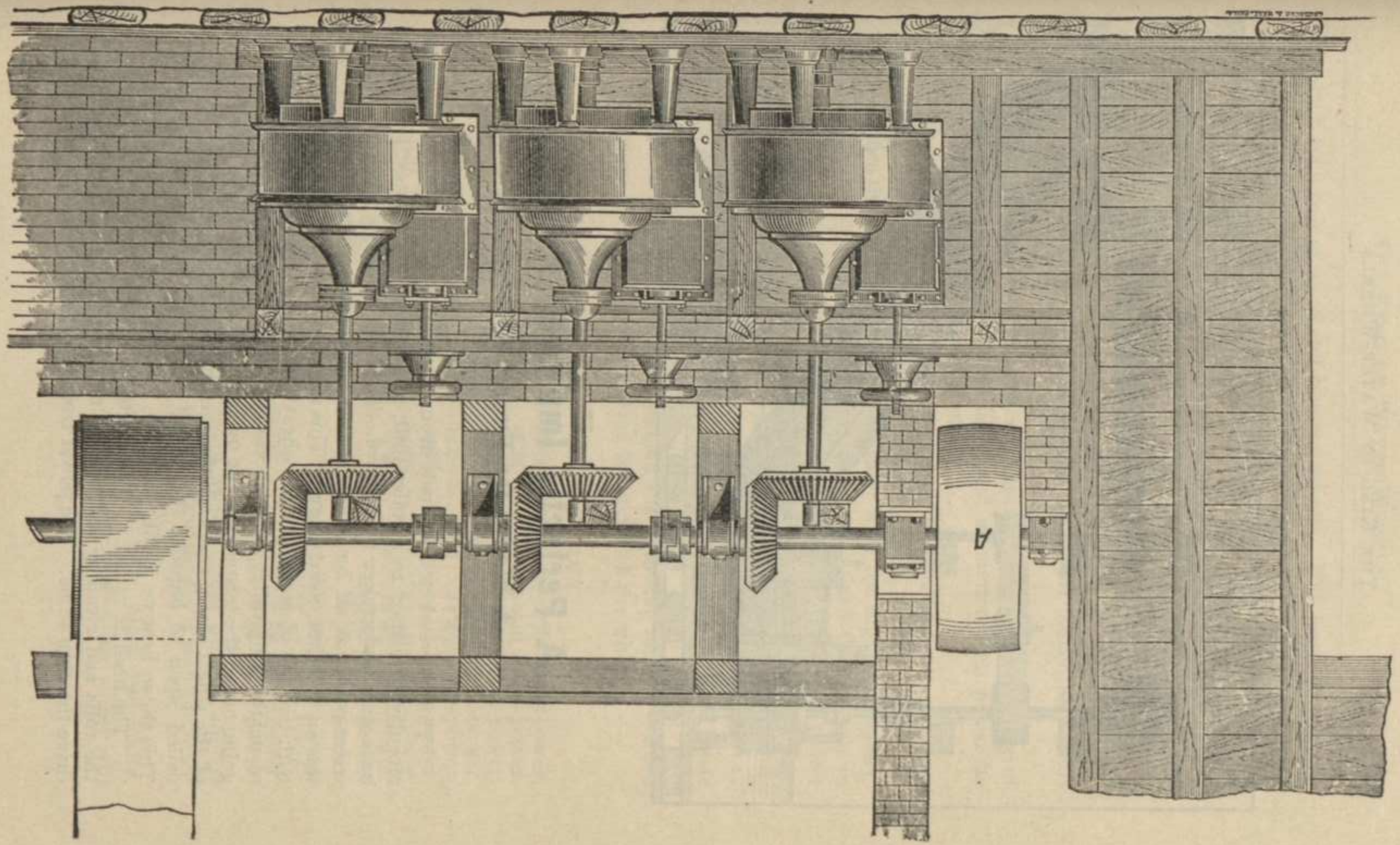
This plan of setting wheels is one which deserves your most careful attention, more especially if you use steam in connection with your water-power. The cut here given shows the manner we have placed wheels during the past year in the large roller flour-mill of Mr. Samuel Van Gundy, Milton, Mo., the large hat factory of Mr. C. A. Lighthipe, of Milburn, N. J., the worsted mills of the Lymansville Co., and the Geneva Worsted Co., Providence, R. I., and many others. The scheme is simply this—*use a number of small wheels instead of one big one.*

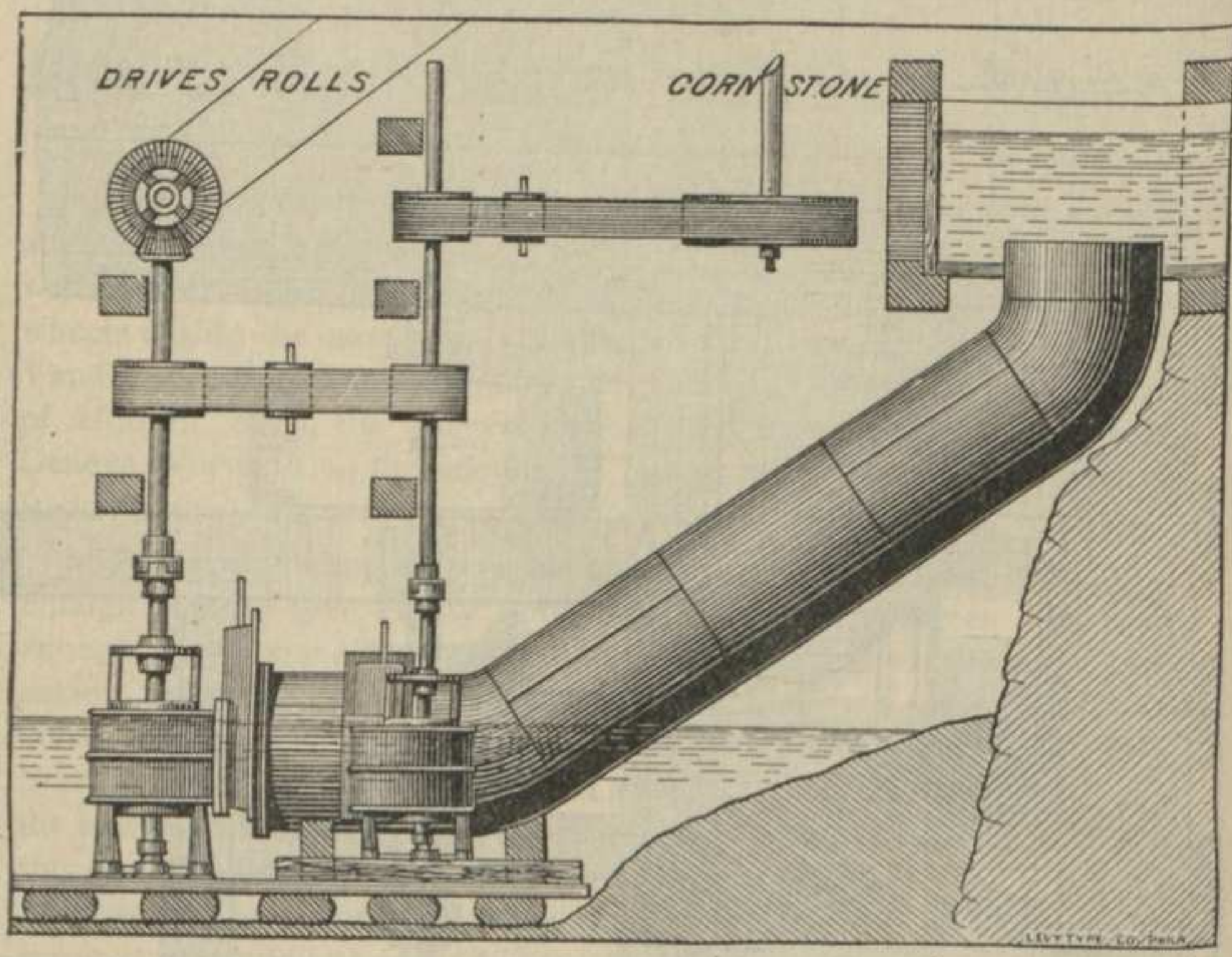
For instance, suppose you have fifteen feet head, and ordinarily, enough water to give eighty horse-power. At many times you have enough to give you a hundred and thirty horse power, but during the dry season, only about one-half the ordinary quantity, or enough for forty horse power. Such variableness is the situation of hundreds of mills. Now, if you already have, or should select a 60 inch wheel to give you the one hundred and thirty horse power, you would be obliged to run this size wheel most of the time at part gate at a loss. That don't do. Suppose you have a 48 inch wheel, then in the dry times you have to run it at part gate at loss, and in the flush times, see hundreds of horse-power going over your dam, or through your waste gates, while you are wishing you had more power, or are burning up tons of costly fuel. Is that business?

Suppose, now, in such a case as this, you put in three 36 inch "Perfections," as shown in this and following cuts. You see the advantage at once! When water is plenty, use all three and get full power. When the flushness is over, use two and get eighty horse-power, and when dry times come, use one and get the full 80 per cent. and forty horse-power, instead of stopping or throwing off the water-wheels altogether, as you would have to do with a single large wheel. Such an arrangement will pay for itself in a year or two, and the first cost would be but little greater than a single large flume wheel. The other advantages are many, which our cuts show more vividly than we can describe.

The above is the scheme. The details may be varied to suit any case or circumstances, or the ideas of millwrights and mill-owners. No two cases are exactly the same. Prices and other information will be cheerfully furnished upon application, and we will take pleasure in referring you to the many mills where we have introduced our system, as briefly outlined above, and where we are making the saving there indicated.

Double "Perfections" can be set in the manner here shown.


A



A Perfectly Improved Power.

A Model for Every Mill-Owner.

The above sketch is made from the working drawings of a plant recently furnished to a roller mill, upon one of the lightest streams we have ever undertaken to improve. The mill is only enabled to run by water-power at all by having a very large dam. The wheel displaced was an overshot, nearly new. This mill was formerly a small burr mill, with two run of stone, one for wheat and one for corn. The competition of neighboring roller mills necessitated either the changing to rolls or going out of the business. The owner decided to put in the rolls in place of the wheat stone, and keep the corn stone for feed grinding. We were called upon to improve the power in the best manner we knew how. This shows how we did it :

The head is 14 feet. We selected a double 18-inch wheel to drive the rolls and cleaning and bolting machinery, and a double 14-inch to drive the corn stone. The power from the 18-inch wheel is taken on to

line shaft by a pair of wood and iron cog wheels. The burrs are driven by a belt and suitable pulleys. The wheels are also provided with pulley on shaft of each, so that the power of the 14-inch can be attached to the 18-inch and power of 18-inch attached to 14-inch. That is, the power of either or both wheels can go to corn stone or rolls at desire of the miller. As the forebay that served the overshot was new it was not disturbed, and as steel cost no more than wood, a steel pipe is used to supply the wheels, as shown, being taken into bottom of the forebay. The 18-inch is bolted to end and the 14-inch fastened to the side.

The arrangement is extremely simple, not at all costly, and thoroughly durable.

The beauty of it is, the miller always gets the highest percentage of his water, whether he uses much or little, and no matter what power he is using the speed always stays the same.

We guarantee the highest percentage from 6 horse-power to 32 horse-power, and there is no mystery whatever about it, as will be shown. Not only does the miller always use his water with the highest economy, from his smallest to his greatest power, but he is so fixed that he can in a moment, by manipulating his tightener and gates, throw the power just where he wants it. If his feed grinding is pushing him, he can shut down the rolls and throw the whole power on the corn stones, or if he must make more flour he can throw all the power needed there. As water gets low he can regulate the wheels to suit and at no time waste his water.

To show how this economy is obtained the following table is worked out. It is done by simply manipulating the gates of the wheels:

EIGHTY PER CENT. ALL THE TIME.

18 at full gate	and 14 at full gate	= 19·66	+ 13·12	= 32·78	horse-power.
18 at full gate	and 14 at ¾ gate	= 19·66	+ 9·80	= 29·46	horse-power.
18 at ¾ gate	and 14 at full gate	= 14·69	+ 13·12	= 27·81	horse-power.
18 at full gate	and 14 at ½ gate	= 19·66	+ 6.56	= 26·22	horse-power.
18 at ¾ gate	and 14 at ¾ gate	= 14·69	+ 9·80	= 24·49	horse-power.
18 at ½ gate	and 14 at full gate	= 9.80	+ 13·12	= 22.92	horse-power.
18 at ¾ gate	and 14 at ½ gate	= 14·69	+ 6·56	= 21·25	horse-power.
18 at ½ gate	and 14 at ¾ gate	= 9·80	+ 9·80	= 19·60	horse-power.
18 at full gate alone				= 19·66	horse-power.
18 at ½ gate	and 14 at ½ gate	= 9·80	+ 6·56	= 16·36	horse-power.
18 at ¾ gate alone				= 14·69	horse-power.
14 at full gate alone				= 13·12	horse-power.
18 at ½ gate alone or 14 ¾ gate alone				= 9·80	horse-power.
14 at ½ gate alone				= 6·56	horse-power.

Any other head and any other sizes of wheels would produce similar results. Are we extravagant in our claims when we say a man can often save cost of steam engine by using "Perfections?"

No other water-wheel builder dare guarantee in black and white, and put down the exact figures as we do, because no other wheel will produce such wonderful results.

How to Save Water.

This cut shows an 18 inch and 21 inch "Perfection" having displaced a 27 inch flume wheel, this flume wheel having previously displaced an overshot and using the old cog gearing. The same decked penstock is used for the "Perfections," it being still good. Had we done the job in the first place, we would have used a straight spout. The upright shaft of the flume wheel has been cut off, and is carried in a step. The power is belted from the two wheels to this shaft. We think the construction is clear. It shows millers how they can use a wheel for each run of stone under difficult circumstances. It would, of course, be best to belt directly from water-wheels to spindles and throw the cog gearing away. Each of the belts should have a tightner, and there should be a platform under them to rest on when slackened.

With the old flume wheel, when water was plenty, there was no trouble, as it would drive both runs all right, but when dry times came, and the wheel had to be run at part gate on one set of burrs, it took so much water that only half time could be made. It will be seen, that with the present arrangement of the "Perfection," when water is scarce only one wheel is used, and that at full gate giving the highest percentage *at the very time that it is most needed*, and it may be the 18 inch or the 21 inch, depending upon the stage of the water. Sometimes we would use both wheels of the same size or a 16 inch and a 21 inch, or divide the wheels as best suits the circumstances.

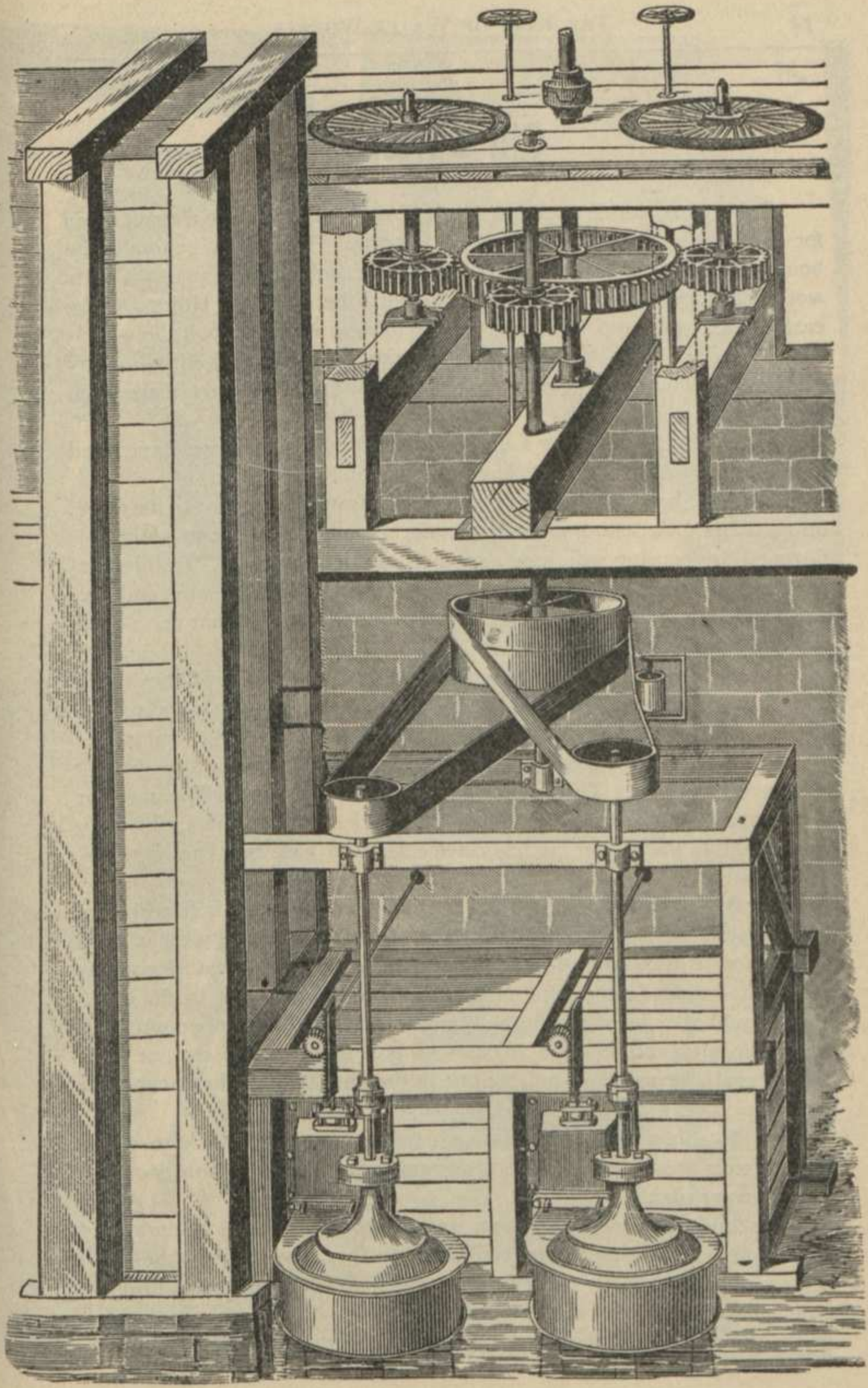
With an arrangement like this in principle—a wheel for each run of stone—there is no water-wheel, either turbine or overshot, that can work water so economically, and where millers have now to use steam in the dry times, they can often, in many cases, by such an arrangement, either do away with the engine entirely or save many dollars worth of fuel.

A great many mills never want to drive more than one run of stone at a time, in which case, if the old overshot gearing is used, the wheel can be set under and coupled to counter shaft. The pinion on the counter shaft should be as near as possible the same size as pinions on spindles.

We wish to impress upon millers the great merit of using a wheel to each run of stone when it is desired to drive two runs at a time, and on variable streams it is often a good idea to use two wheels when only one run is used at a time.

The cost of "Perfections," when everything is taken into consideration is no greater than that of a single flume wheel to do the same work.

Double "Perfections" can be set in the same manner.



Old Boilers.

Old boilers, which are unfit for generating steam make elegant pipes for bringing water to "Perfection" wheels. They can generally be bought at the price of scrap iron and are in such a shape that but little work is required to adapt them for use with the wheels. Holes can be easily patched up and heads cut out. Holes to which to bolt the wheels can be easily cut in the proper places with a narrow cold-chisel by any mechanic. The joints between gate boxes and the pipe are made with lead without trouble.

The opposite cuts show four of the hundreds of ways we have used old boilers in connection with the "Perfection" wheels.

No. 1.—Shows a boiler leading directly from the forebay to the wheel on an angle. A casting is made to suit the end of the pipe to which it is fastened by pouring with lead and then caulking it tight. To this casting the gate box is bolted. Sometimes we make the gate box and this casting all in one. The boiler must be supported so that none of its weight comes upon the wheel.

In the corner is shown two wheels bolted to the end of the boiler This can be done when the boiler is large enough or the wheels small enough to bring the openings of gate box within range of the boiler.

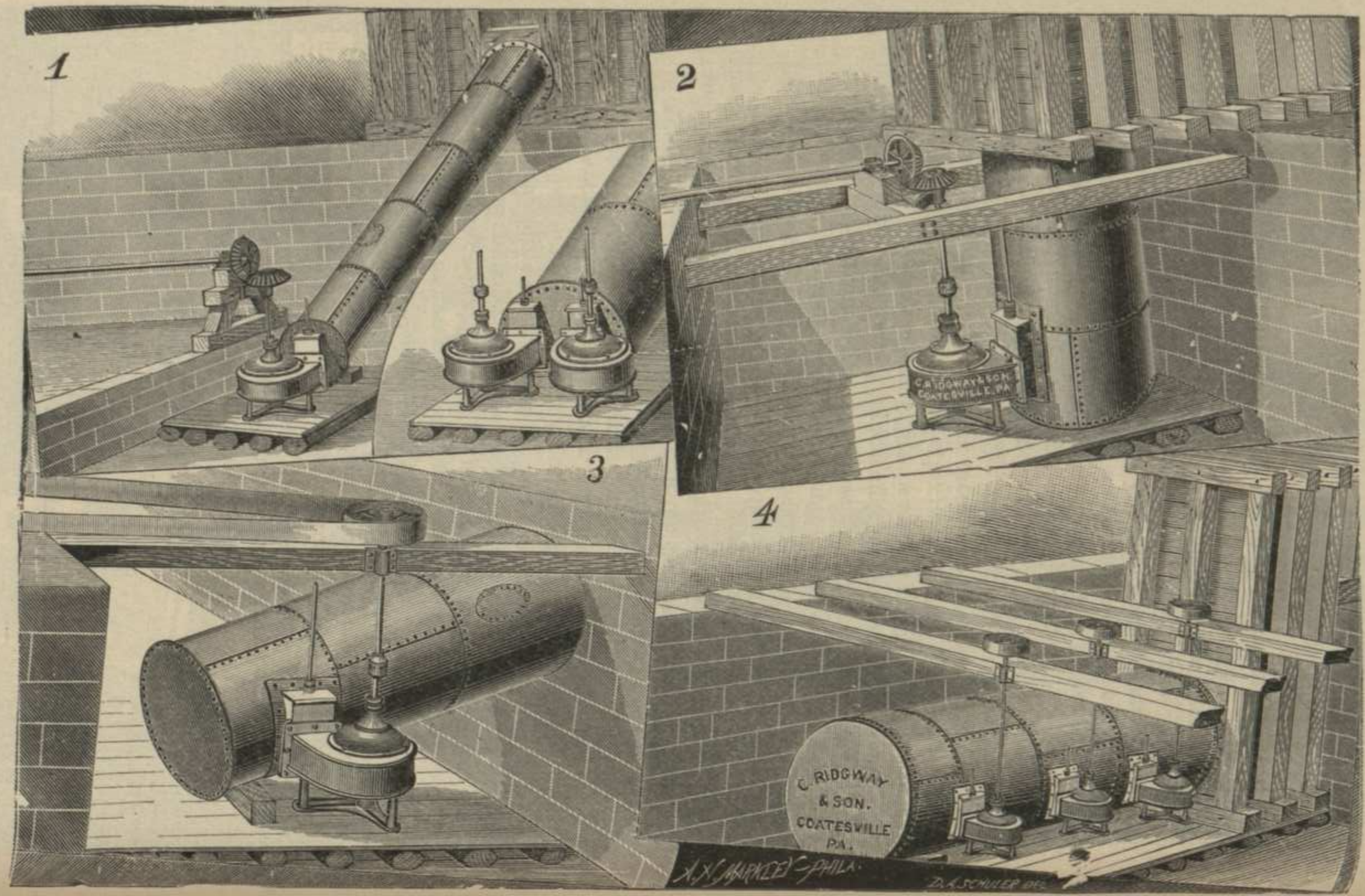
No. 2.—Shows a boiler standing vertical and the water brought to it by a wood forebay. This makes a capital arrangement. The gate box is fastened to the boiler by putting wood blocks between them which are worked out to the proper circle, or a special iron gate box can be made, using lead joint.

No. 3.—Shows a wheel bolted to side of an inclined boiler when it is impossible to bolt it to the end as in No. 1. In this style the joint between gate box and pipe is made with wood and it is a nice job to make the wood fit the pipe. It takes a good millwright to do it. A wheel could also be bolted to the opposite side, which plan we often use when the pipe is not large enough to bolt them to the end, or three wheels could be used by bolting one to the end besides the two on the sides.

No. 4.—Shows boiler used as an extension to a penstock to which three wheels are bolted. This is the same arrangement as on page 24 on a cheaper plan.

We think these cuts tell their story better than words of ours, and like all the other cuts in the book, still further demonstrate the great value and merits of the "Perfection" to all those who want to improve water power in the best of manner at the lowest of prices.

Double Wheels can be set in the same manner.


1
2
3
4
C. RIDGWAY & SON. COATESVILLE PA.
C. RIDGWAY & SON. COATESVILLE PA.
C. RIDGWAY & SON. COATESVILLE PA.
A. X. SCHARFLEY & PHILA.
D. A. SCHULER DEL.

A Cheap Plan.

A very cheap and at the same time one of the very best of ways to set a "Perfection" wheel, is shown in the opposite cut. The wheel is a 14 inch under 24 feet head. The water is brought to it in an inclined wood spout 30 inches high and 20 inches wide on the inside. This trunk is constructed as described on page 53. The spout is laid upon a good stout timber, well supported to keep it from sagging. This plan of setting the wheel and bringing the water to it is a good one for any head.

In the cut the wheel is shown set just outside the building, which can be a factory of any kind, the front of the building being removed. The wheel is shown driving the line shaft by a quarter twist belt, which is a capital way when the pulleys can be nearly the same size and the distance between shafts ten feet or more. If from the location the wheel came at the end of the building, or under the building, then the power would best be taken off by means of bevel mortise gears.

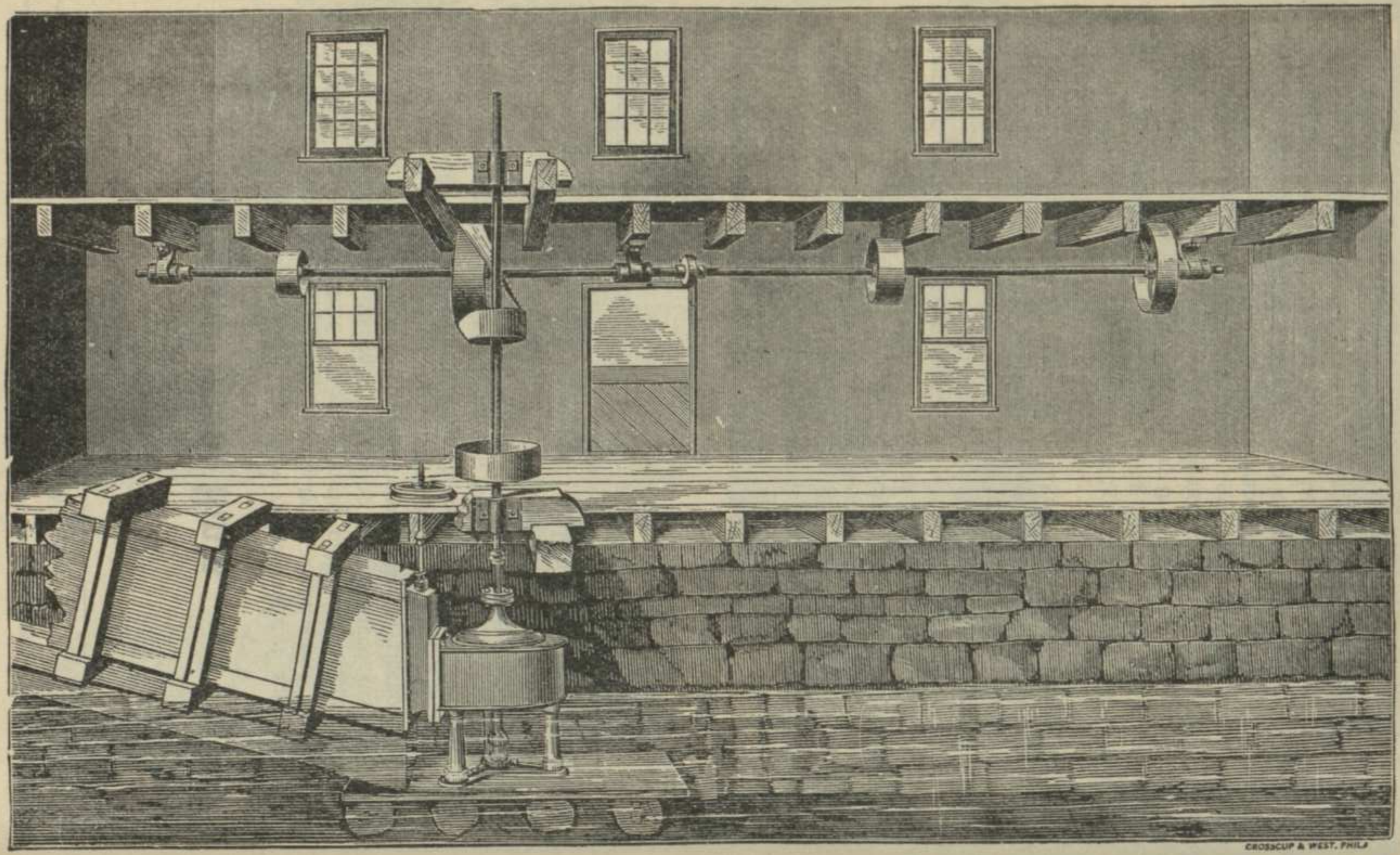
When the wheel sets outside or near the building, the floor timbers can be extended to carry the upright shaft. The first pully on upright shaft is intended for driving a corn mill.

The plan here shown is one which admits of many modifications to suit circumstances. It will be found of especial value, however, in those remote parts of the country where good millwrights are not to be had. Any kind of a mechanical sort of a fellow can easily set up a "Perfection" wheel, and make one of these simple, cheap and good spouts.

There are hundreds of small factories which can be built on water powers, by using the "Perfection" wheel. The cost is so reasonable, that parties of limited means can use them, who could not well afford to buy an expensive flume-wheel and hire mechanics to put in weeks building the costly penstocks they require.

We have sold immense numbers of the "Perfections" for driving such small factories, such as turning mills, cider mills, cotton gins, small wool and cotton mills, furniture and wagon factories on a small scale, creameries, forges, sash saw mills—in fact hundreds of little concerns too numerous to mention. Notwithstanding many of these little establishments are on the highest and most insignificant little streams, every wheel we have sold has delighted its purchaser.

Double "Perfections" can be set in the same manner.



CROSSCUP & WEST, PHILA

Some Good Hints.

The cuts on the opposite page show various ways of setting the "Perfection" and shows its great adaptability for all purposes.

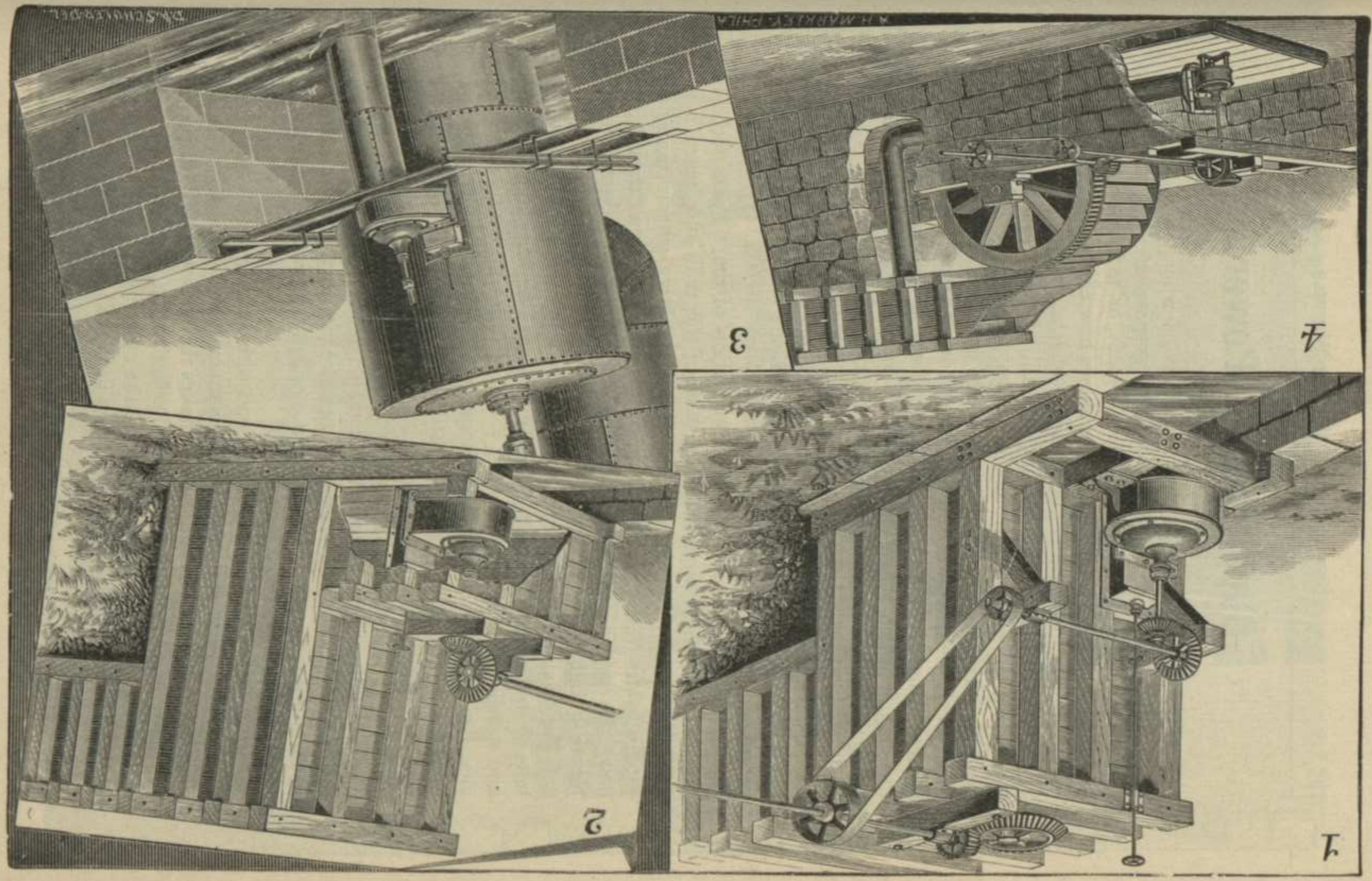
No. 1 shows a "Perfection" bolted to the outside of an open penstock and geared so as to assist the flume wheel placed inside the penstock. It is also a striking contrast between the "Perfection" and flume wheels. There you have the "Perfection" where it can always be seen and got at, while the flume wheel with its cogs, rods and other claptrap is down under the water, out of sight, where it soon rusts and wears out. This cut also gives a hint how parties can displace flume wheels by the "Perfection," with but little change or alteration.

No 2 shows a "Perfection" wheel set inside a decked penstock in place of a flume wheel. In this way, parties can test the "Pefection" in comparison with a flume wheel they may wish to displace without expense, and then finding it satisfactory, the deck may be torn away and the wheel as set in No. 1 outside the water. Some rival wheel builders undertake to find fault with the "Perfection" because it sets outside the penstock, but it is evident to any one that a man need not set a "Perfection" outside if he don't want to. It sets inside like any flume wheel, and on account of its simplicity and tight gate really makes a better flume wheel than any of the many now upon the market.

No. 3 shows a "Perfection" fastened to a large iron case containing a flume wheel of great power. It is often desirable to get a lighter power for driving special machines such as Electric Light, Fire Pump, Machine Shop, etc., without having to run the big wheel, or to get power at times when the water is too low to run the big wheel. Light **I** beams are shown thrown across the girders carrying the case, to these they are fastened by clamps, being connected by another beam which supports the wheel as is clearly shown in the cut. Power can be taken off in any approved way or one of our Turret wheels could be used.

No. 4 shows a little "Perfection" helping out an overshot. Compare them. To think of that little thing doing the work of the monster beside it! In many places parties can try the "Perfection" in this way before tearing out the overshot. You will notice we are great in having our wheel tried alongside of other wheels and show ways how it can be done. It is because we know there is no water-wheel on earth can equal it, and every trial but adds greater glory to its merit and renown.

We think the cuts on this page cannot fail to impress every thoughtful man of the great merit and value of the "Perfection" wheel, and its just claim to the title KING OF TURBINES.



Supplemental Power.

There are hundreds of factories and mills where it is desirable to add to the present power, either for the purpose of using the surplus water that pours over the dam or waste gates, or to drive some special machinery. The opposite engraving shows how easily and cheaply this may be done by using the "Perfection" wheel.

This cut is taken from the fine new mill of the Susquehanna Water Power and Paper Company, at Conowingo, Maryland, At this mill the head is twelve feet, and the large wooden penstock shown contains six immense Leffel wheels of three hundred horse power each. The "Perfection" wheel shown on the left is one of our 30 inch draft tube wheels, the shaft of which passes up through the floor, and drives by means of a quarter twist belt (not shown), a line shaft, from which latter is driven the Edison Electrical Machine for lighting the mill. To the right of the cut we have also shown one of our recently patented Turret wheels driving two Gramme Dynamos, in order to indicate one of the ways it may be applied.

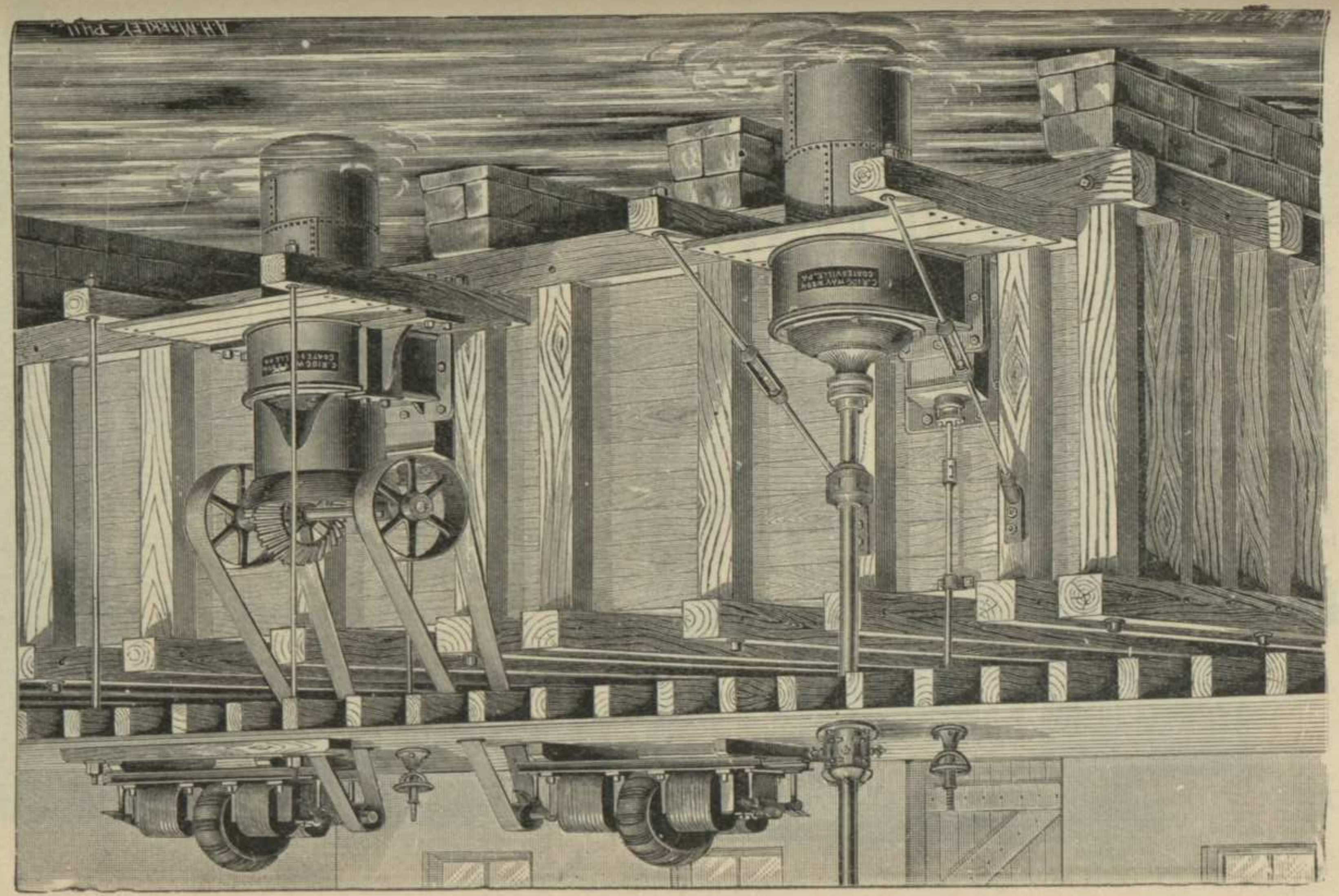
In this mill, previous to the introduction of the "Perfection," the Dynamo was driven from the main shaft of the mill, and hence it was always necessary to keep at least one of the large wheels running to supply light. When anything happened in the night requiring a shutting down, the mill was left in total darkness at the very time they most needed plenty of light.

For driving Electric Lighting Plants by water power there is no turbine so well adapted as the "Perfection," as its simplicity, and durability, and steadiness of motion are most valuable features for this sort of service. It does not do to have stoppages and delays, or wheels getting out of order. When the gate is drawn the "Perfection" will run a year without a stop if necessary.

We think this cut fully explains itself, and will suggest to many mill owners who see it the advisability of employing "Perfection" wheels in this manner, either for driving dynamos, fire pumps, and other machines, or for utilizing surplus water in times of plenty, to aid in driving the mill to the saving of the coal pile.

We would be pleased to correspond with any parties who may desire to add to their present power in the manner here indicated. The very low cost of the "Perfection" wheel makes the improvement a cheap one.

Two ways of supporting the "Perfection" are shown, one by tie rods to the posts of the penstock, and the other by tie rods to the floor above. Posts could also be put down in the tail-race to carry the timbers supporting the wheels if there was nothing to prevent. Any such plan as best suits the taste of the owner or the circumstances of the location can be used.



Belted Grist Mill.

This is an excellent arrangement for a grist mill driven by one wheel, and we have furnished hundreds of such rigs. In the cut here shown the arrangement is so plain but little explanation is required.

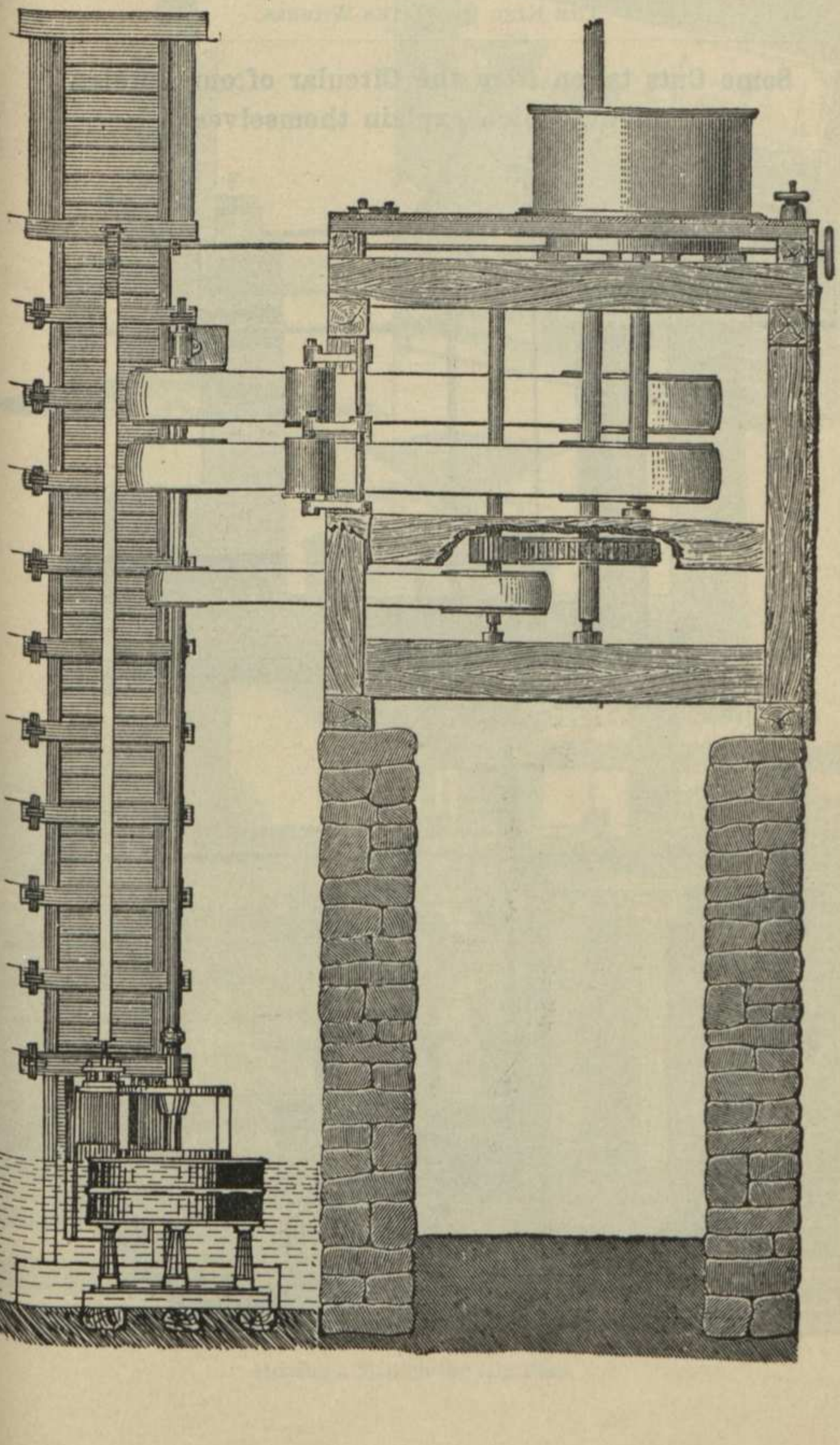
When the stream is a good one, furnishing for most of the year power enough to drive both run of stone, a Double "Perfection" is used, which, at full gate, gives from 16 to 25 horse-power. The great value of the Double "Perfection" is shown in this example very plainly; for when the stream drops off in dry summers to only water enough to drive one run of stone, the double wheel is run at half gate, and gives the same high percentage as it does at full gate, thereby using the water economically at the very time economy is urgently needed. Besides, the speed is exactly the same as at full gate, and the miller can make just as nice flour and meal as he could with plenty of water. With any other water-wheel it would be impossible to do any work at half gate; the use of water would be so wasteful, and the speed so irregular, that the miller would give up in disgust.

We think nothing could so thoroughly convince a mill-owner that the Double "Perfection" is the only wheel he should think of putting in his mill than this case.

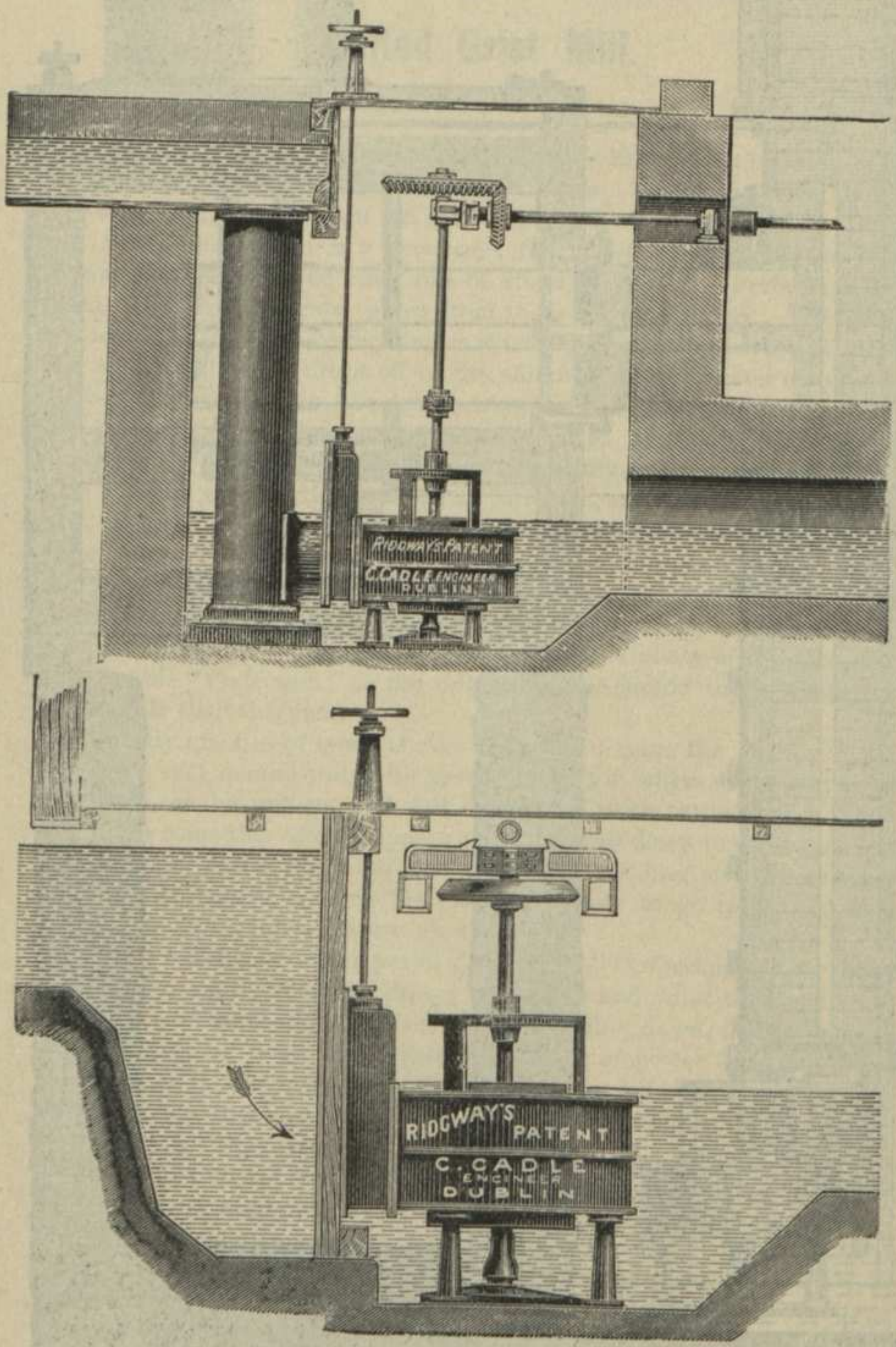
If only one run of stone is ever driven at a time, the Double "Perfection" still demonstrates its great value, for when water is plenty full feed can be put on, and full amount of work turned out. When dry times come the "Perfection" can be dropped down to three-quarters or half gate, and a good business done, and a miller spared the mortification of having to turn his customers away to go to a rival mill because he didn't have power to do the work.

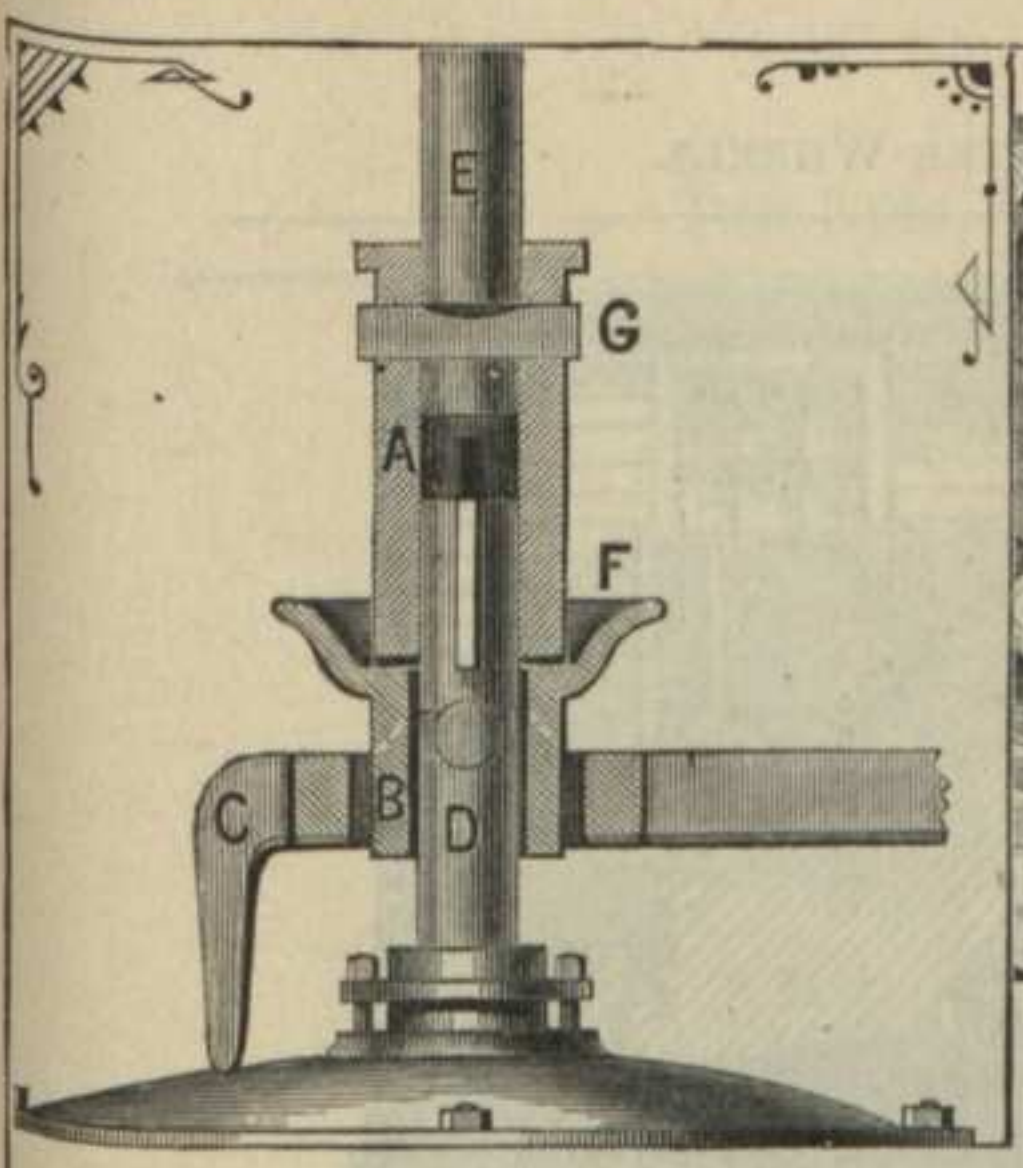
Many millers who have put in the Double "Perfections" have been able to run, while their neighbors who have had what they supposed were the best of wheels, have been obliged to shut down, simply because the "Perfection" gives the highest percentage of power from the water when water is scarce and high results are needed, while every other wheel gives a high percentage only when water is abundant and wastes it when it is the scarcest.

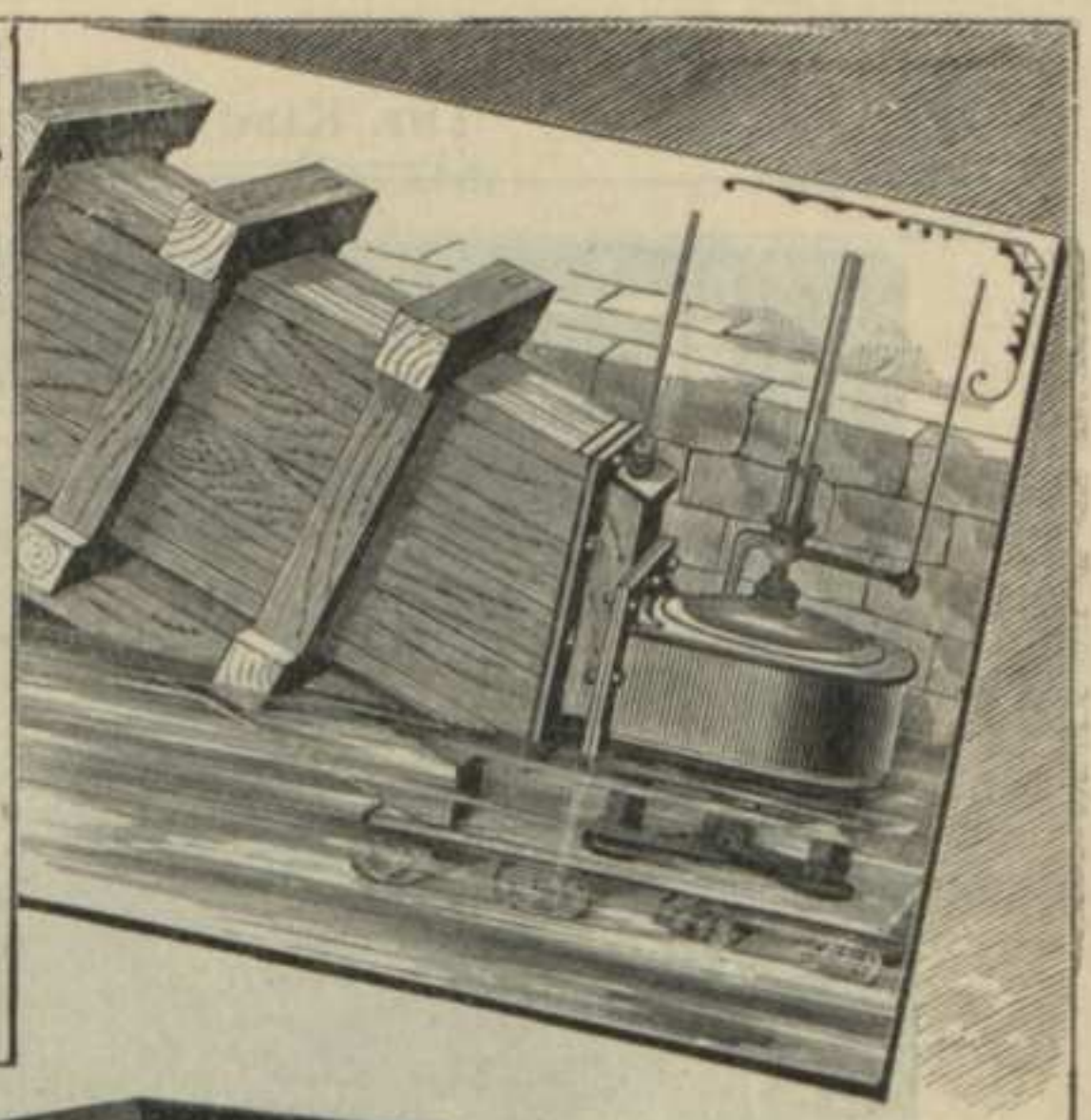
We think if the reader would visit us and see the many letters we get, calling on us to displace other wheels with the "Perfections"—not old, worn-out wheels, but new ones just put in—he would hesitate a long while before he would go to work and make the same mistake. Write us and we will furnish you bushels of testimonials from parties who have put in "Perfections," so you can see what they say.



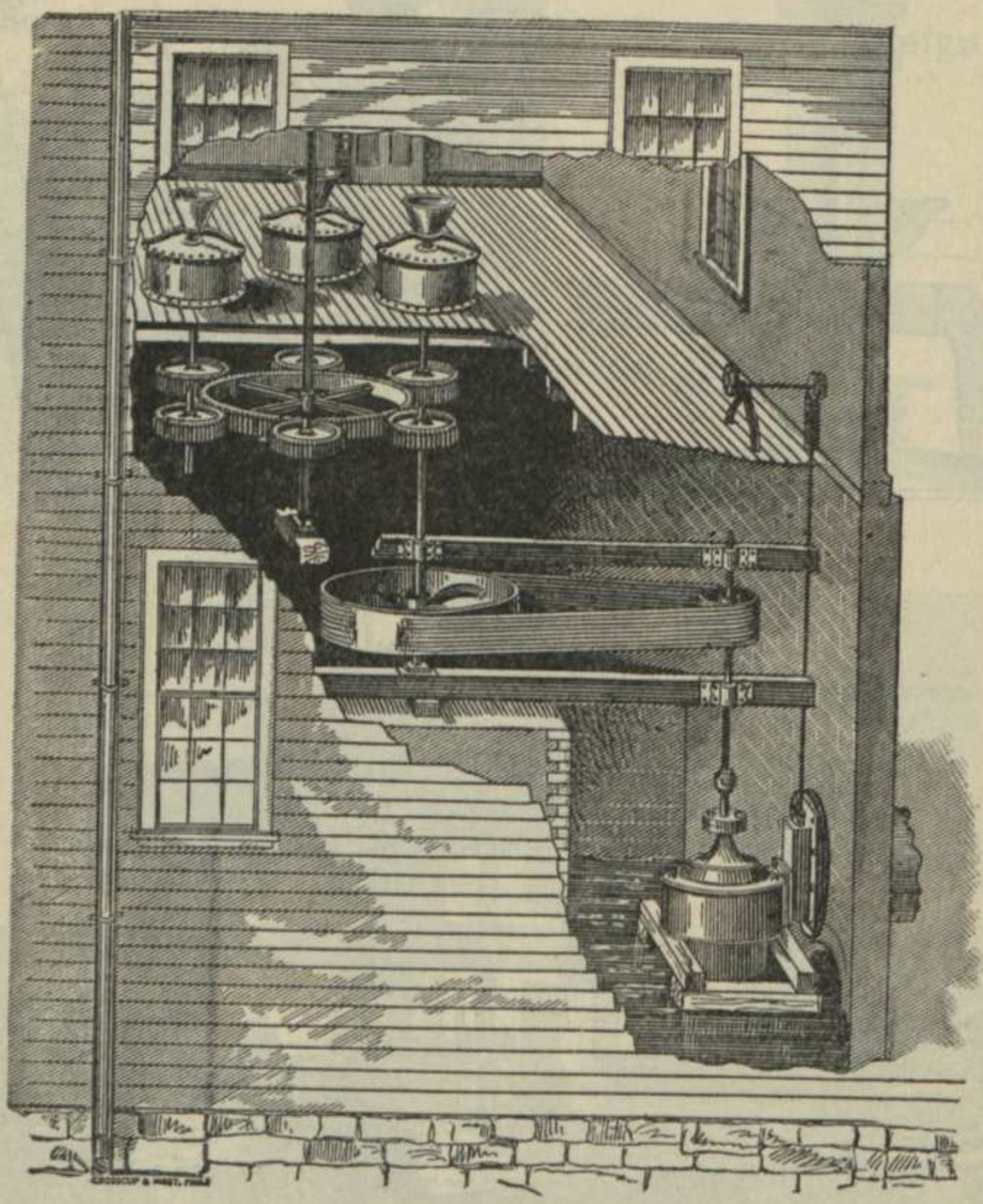
Some Cuts taken from the Circular of our Foreign Agent, which explain themselves.







Driving a Mill on the Gig Plan.

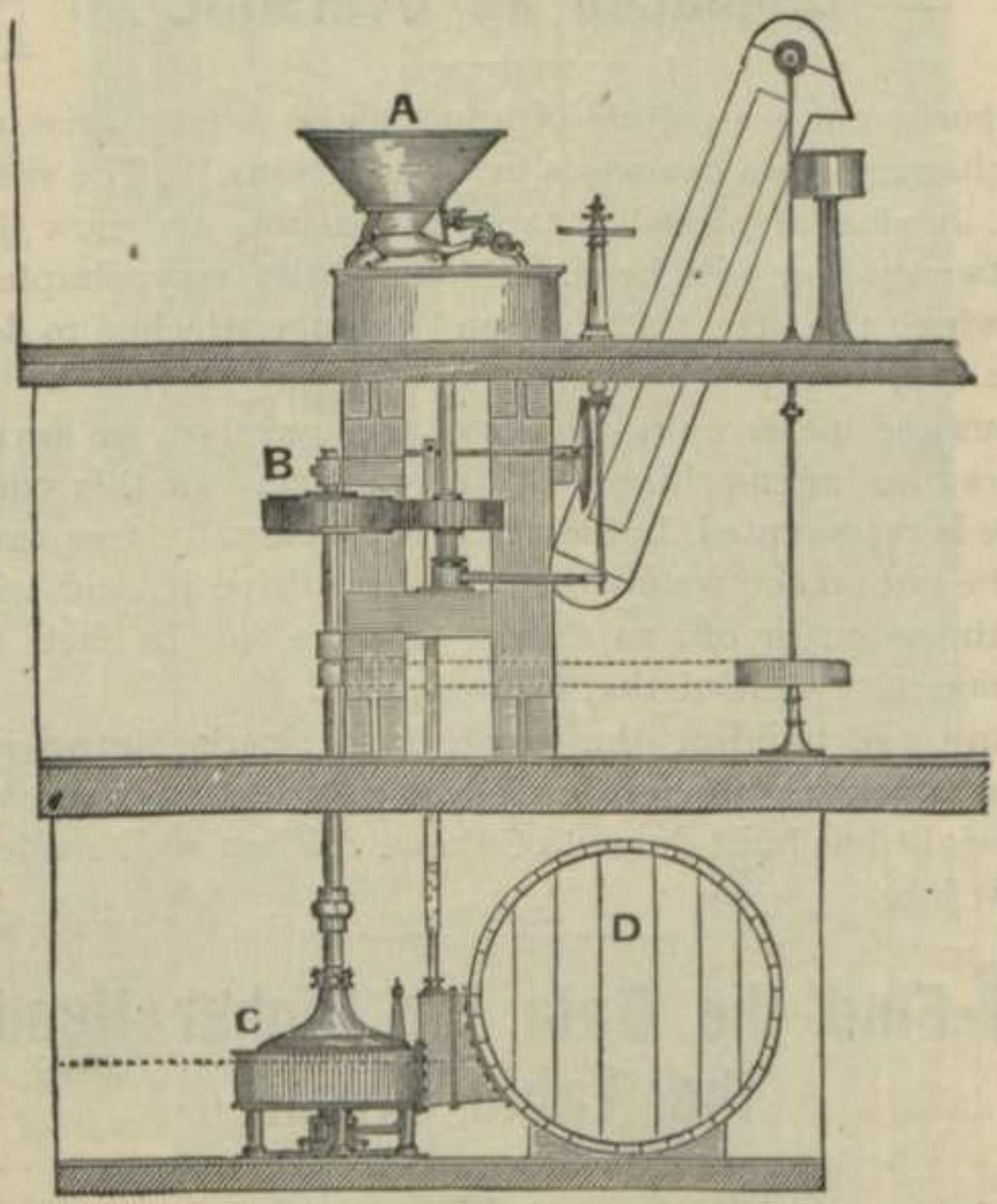


Driving a Geared Mill.

The above cut shows a single wheel under a high head driving a flour mill, in which the old gearing used with the overshot is still employed. Water is led to the wheel in a cast-iron pipe, and on account of a bad tail-race or pit the wheel is set with a short draft tube instead of on legs. We always urge legs. The power is belted from the pulley on water-wheel to pulley on counter-shaft, carrying pinion gearing into old spur-wheel, around which the burrs are set. The cut is so clear that no further explanation is necessary.

There are many mills driven by overshots that may be changed in this way. When it is desired to drive more than one run at a time, we advise the plan shown on page 70, when it can be used.

GRIST MILL, DRIVEN BY GEARS.



Description of Cut.

This cut is an end view of a mill in which the power is transmitted, from the water wheel to the burrs by means of spur cog gears. We would prefer belts, but oftentimes it is impossible to get the wheel far enough away from the burrs to make belts a success. What we wish more particularly to show in this cut is the round wood trunk and the manner the wheel is fastened to it. When a circular saw can be had and a millwright who knows how to make one, a good round wood trunk is about the cheapest and best arrangement there is for conveying water to the "Perfection." A square upright penstock can be built, and then a round wood one extend from its lower end, to which as many wheels as may be wished could be bolted. The gate box can be fitted to round wood trunk, by either having a special casting made of the proper circle, or by fitting in wood blocks, which is just as good, and bolt through them to the trunk.

The trunk *D* can just as well be the ordinary square kind, and unless a millwright is at hand who knows how to make a round one, we would advise the square trunk.

The number of ways the "Perfection" can be nicely set and applied to work are almost endless, and any intelligent man can readily devise them to suit any location or circumstances.

Double "Perfections" can be set in the same manner.

Displaced an Overshot.

The opposite cut is a picture of hundreds of country grist mills which have been changed from overshots to "Perfections." The wheel shown is a 10-inch, having displaced a 22 feet overshot, and now driving the mill under twenty-four feet head. It shows the very simple and easy manner in which the little "Perfection" may be attached to do the same work as the old, heavy, ice-bound, "slab-sided" overshot. Instead of the cumbrous and massive cog-wheels of the overshot, we have the light and noiseless running machinery of the turbine. In this cut only one run of stone is represented, but as there are generally two run, another pulley can be put on the water-wheel shaft to drive it, and with tighter pulleys to throw on or off, as shown on page 80. In fact, this cut is nearly a perspective view of that arrangement.

The manner of building the penstock is clearly shown in the cut. It is one that is very popular with users of "Perfection" wheels because every millwright has built dozens of them. When well made it makes a good, tight job.

How to Find the Data for Higher Heads than the Table Gives.

It will be noted that the tables of power, etc., are not given for heads greater than 40 feet, except in a few smaller sizes, in which case the limit is 80 feet.

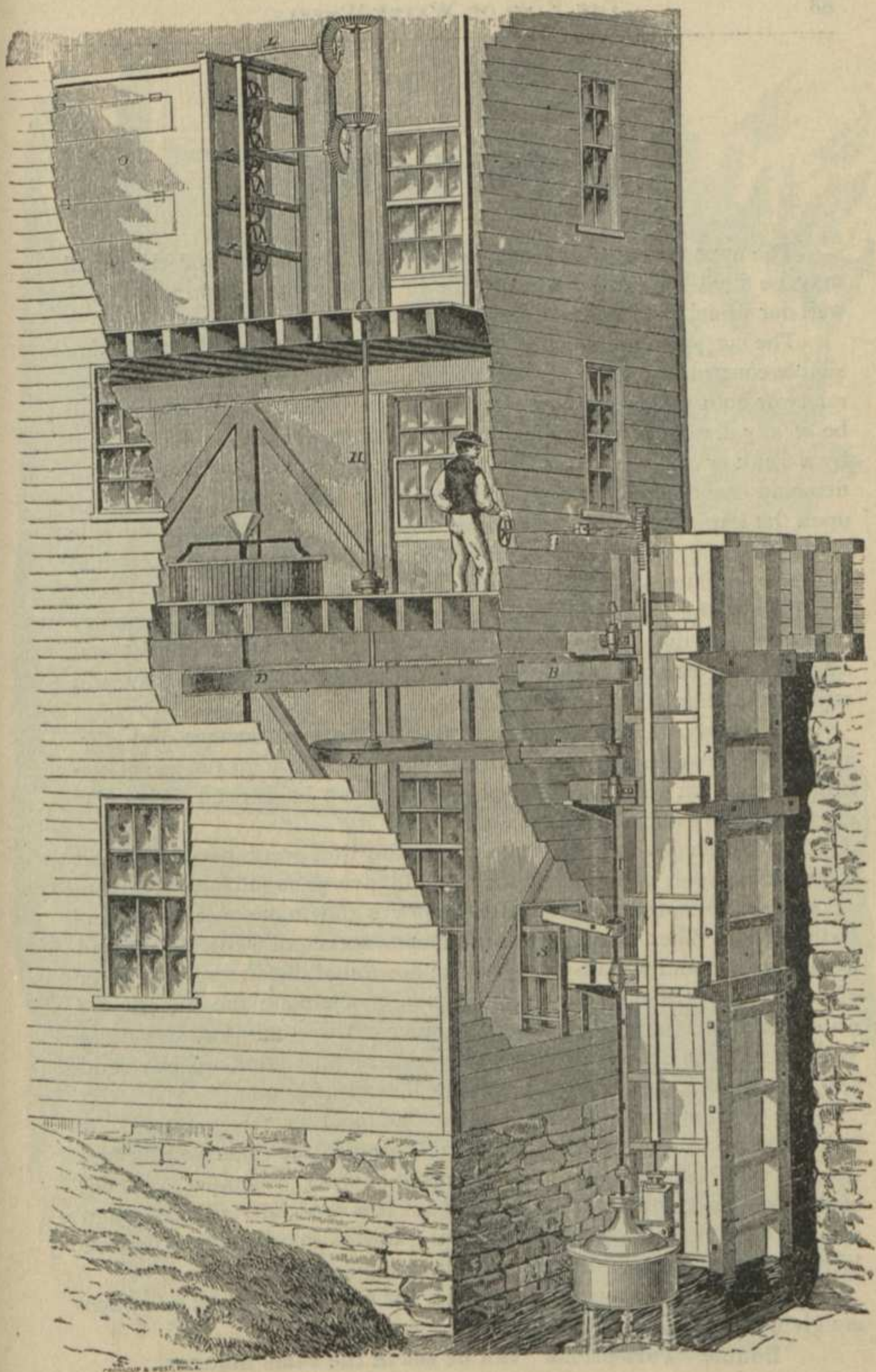
The horse-power, cubic feet used per minute and revolutions for any greater head can be readily found by taking one-fourth the desired head and multiplying its horse-power by 8 and the cubic feet and revolutions by 2.

Example.—Suppose the data is desired for a 24-inch double wheel under 100 feet head. One-fourth of 100 feet head is 25 feet. The horse-power of a 24-inch double wheel under 25 feet is about 82. Cubic feet used, 1,960. Revolutions, 257.

Multiplying 82 by 8 we have 656 as the horse-power for 100 feet head. Multiply 1,960 by 2 we have 3,920 as the number of cubic feet, and multiplying 257 by 2 we have 514 as the number of revolutions of a 24-inch double wheel under 100 feet head.

If the head is so high that even one-quarter of it is greater than tables give, first find the data for this one-quarter and then with that as a base find the data for the desired head, as above described. In this way the power, etc., of a wheel under ever so high a head can be quickly determined.

This rule applies to all water-wheels, singles or doubles, or of any make if their tables are correctly made.



A Frontier Mill.

The opposite cut shows how simply and cheaply a first-class mill may be fitted up with the "Perfection" for a motive power, and how well our wheel is adapted for new countries.

The cut presents, in one view, a saw mill and grist mill, both of simple construction and yet well arranged. Either mill may run separately or both at once, if power of wheel is sufficient. The wheel may be of any diameter from 12 to 48 inches, and the water conducted to it by a trunk or spout, such as previously described, and which any frontiersman can easily construct. The shafting and gearing are carried upon the framework (shown broken), which is firmly secured to the side of the building, or it may be arranged in any suitable manner according to the requirements of the location.

Both of the buildings here shown may be of a more temporary character, and the arrangement varied to suit them; and the grist and saw mill may be portable, which will still further enable the easy and rapid completion of such an enterprise.

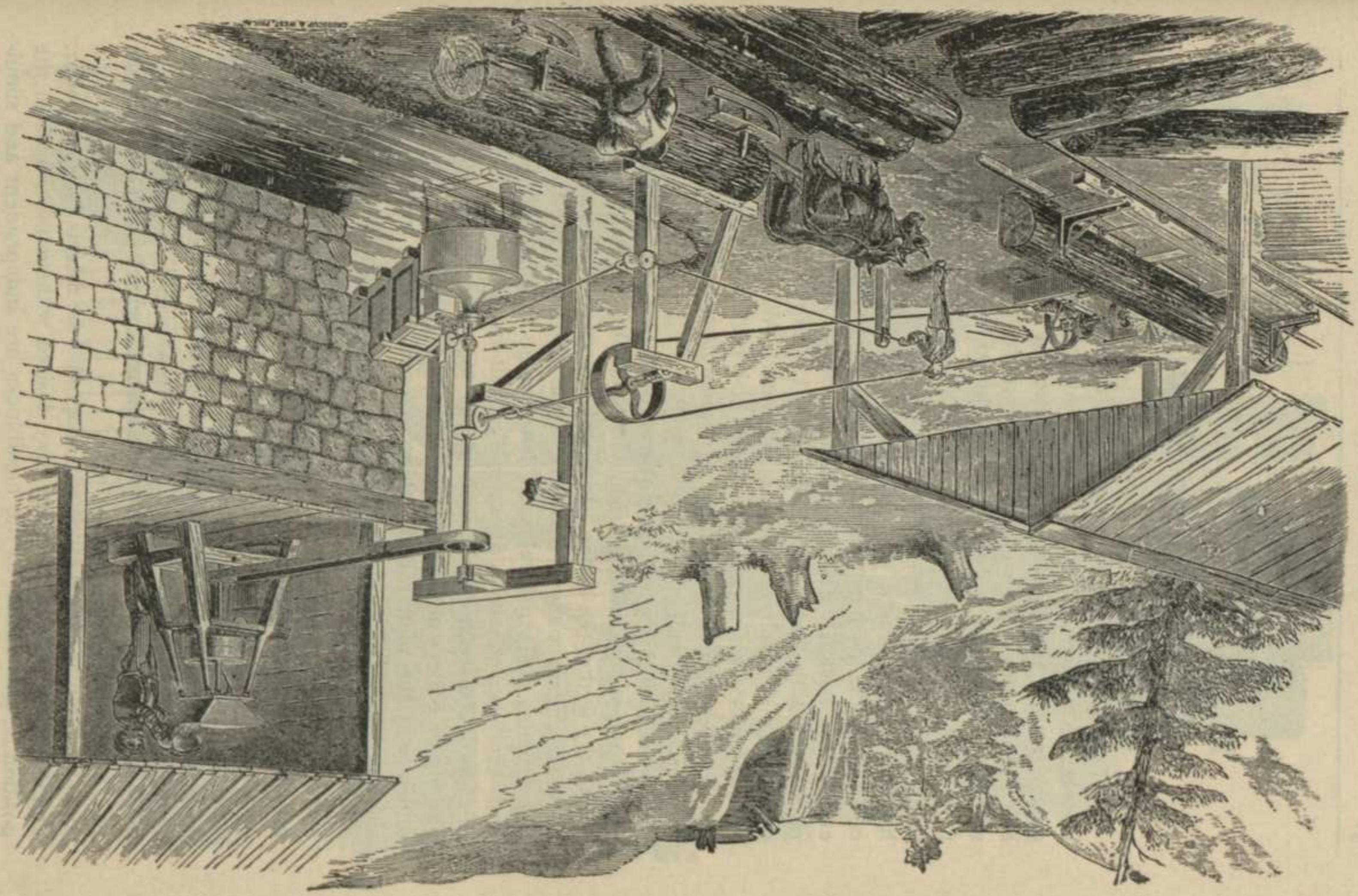
We also recommend this arrangement when a permanent and durable mill is desired, and when parties adopt our wheel for the use of the frontier, they get an arrangement as good as can be devised for similar use in the more populous East.

We furnish gearing, shafting and all the iron work necessary, and when parties wish us to do that, they should give us as full measurements as possible, so that we can estimate the prices and make everything perfectly right. When making measurements make all vertical distance from level of standing tail-water, and all horizontal distances from center of water-wheel (from where it would come). Estimate the quantity of water you have from rules laid down under "Directions for measuring Water." If you desire information for constructing dams, we can send you a good work on the subject if you will send us $1.00.

Our circular saw mill is preëminently adapted for new countries. It has all the improvements of the best mills, and at the same time is free from all small trifling parts liable to get out of order. Nothing to get out of repair a blacksmith can't easily mend. It is especially adapted to go with our wheels, and is equally as simple and as good and as perfect. With it the sawyer does the setting without moving from his post.

We have sold many of these outfits for the far West, all of which are giving the most perfect satisfaction.

Double "Perfections" can be set in the same manner.



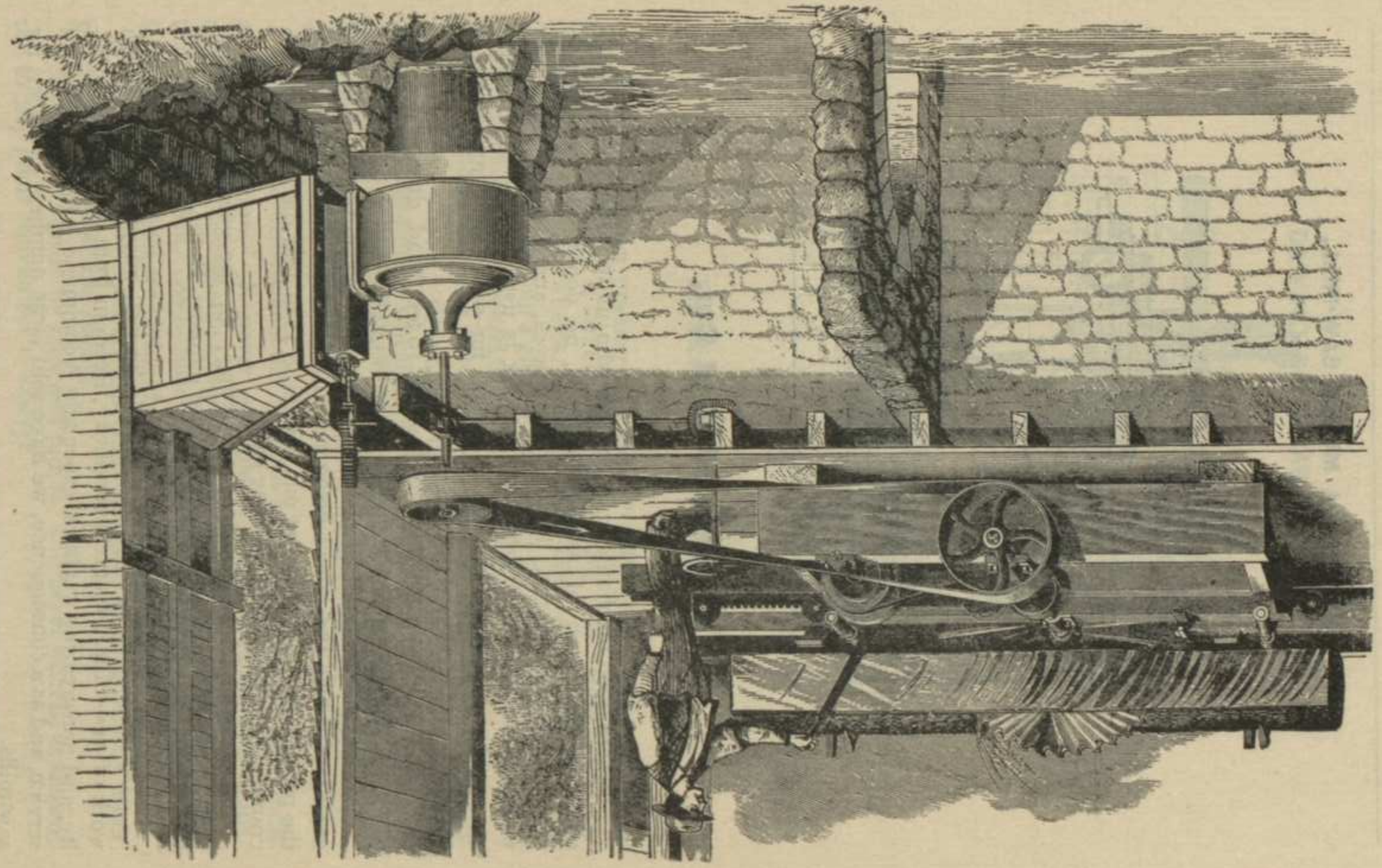
Circular Saw Mill.

The opposite cut shows a manner of setting small wheels under high heads to drive one of our circular saw mills without the use of cog gear. In this case the power is transmitted by means of a quarter-twist belt. The water is shown conducted from the upright penstock to the wheel in a tapering wood spout, which should be very strongly built. In most cases like this we use an iron spout, which is very much better under high heads, but we show a wooden one in cut in order to illustrate how such could be used when desired, Instead of spout a short deck could be made, as shown on page 71, the wheel being fastened to the end instead of side. The wheel is shown set on a frame, resting on stone pillars (which the artist has drawn small so as not to hide draft tube), with draft tube reaching down to tail-water. Wheels with legs should always be used when possible, as the first cost is less, and the toe is easier gotten at, but oftentimes it is impossible to use legs; in such case, wheel with draft will give as good results.

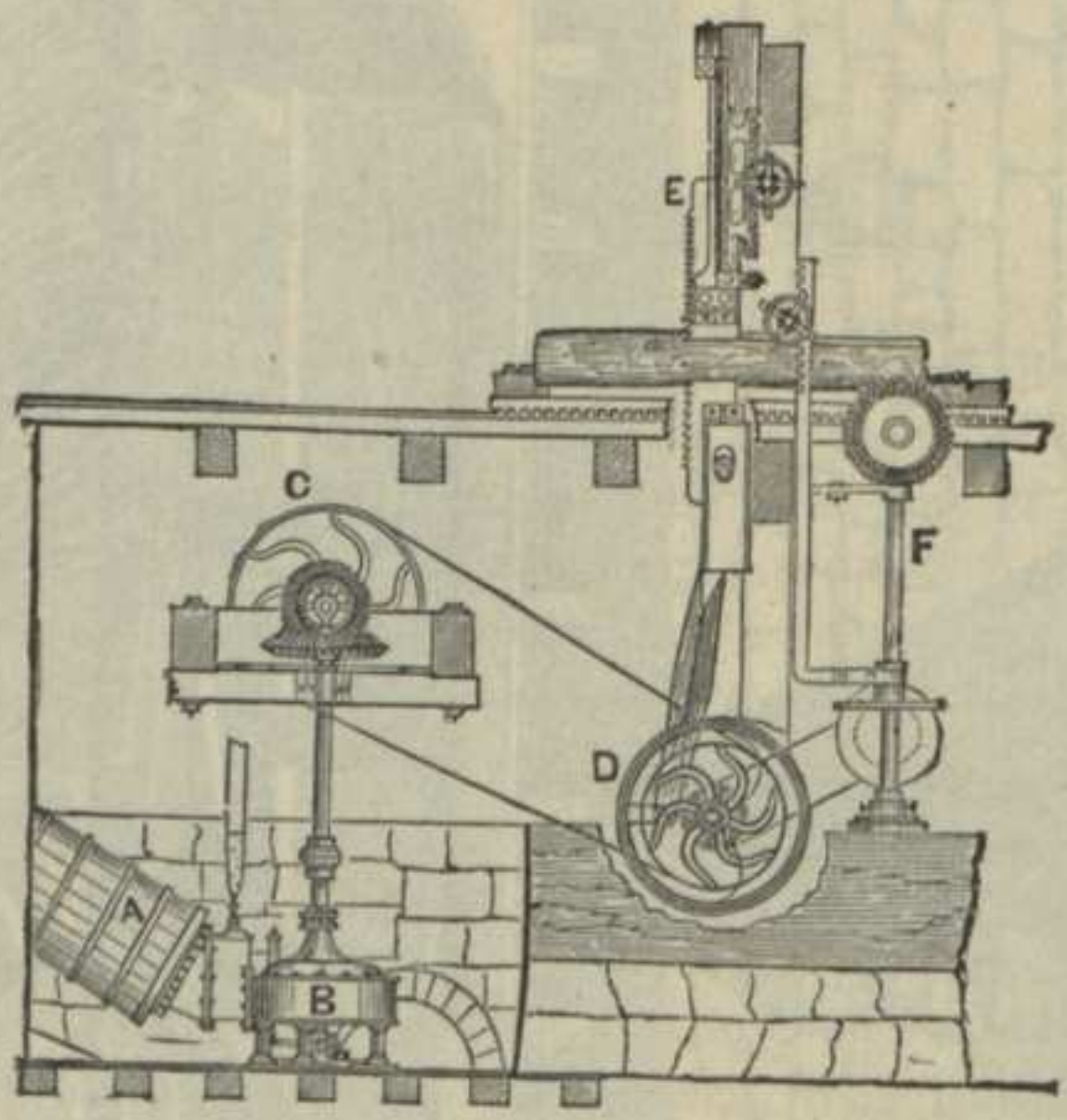
In transmitting power with quarter-twist belt, the pulleys should be as near as possible the same size, and should be from ten to sixteen feet apart—the farther the better. It is well to engage some one who knows about arranging pulleys this way. The middle of the face of water-wheel pulley is on a level with lower edge of mandril pulley. The arrows indicate the only direction the belt can run with the pulleys in this particular relation. If belt needs to run in opposite direction, position of pulleys must be changed to suit. There need never be any difficulty in the matter if the thing is carefully and intelligently considered.

This plan of quarter.twist is often applied for driving line shafting, and all kinds of machinery. We advocate it strongly. There are no practical objections against it, and we will guarantee a belt to last just as long as a straight one, transmitting the same power at the same speed, with the same care being taken of it. Our advice is: Use a quarter-twist belt wherever you can in place of gears. It is better and cheaper, especially for light and medium powers. We can refer you to large cotton factories driven by "Perfection" wheels, with quarter-twist belt, and giving perfect satisfaction.

Our Circular Mill is especially adapted to be driven by water power, and the man can set the log any way desired without moving from the position he now stands, as the headblocks are independent and simultaneous, and are operated from one handle.



DRIVING A MULEY SAW-MILL.



Description of Cut.

Where good mechanics can be had, who understand how to make one, the best form of wooden spout is, no doubt, the round trunk shown at **A** in above cut. It is made of staves, and strongly bound with wrought iron bands. When a round trunk is used, we have to furnish an angular connection for the gate-box, for which we charge extra to wheel.

The cut shows a 16 inch wheel, under 16 feet head, driving a muley saw-mill, and the same arrangement applies to a sash-saw.

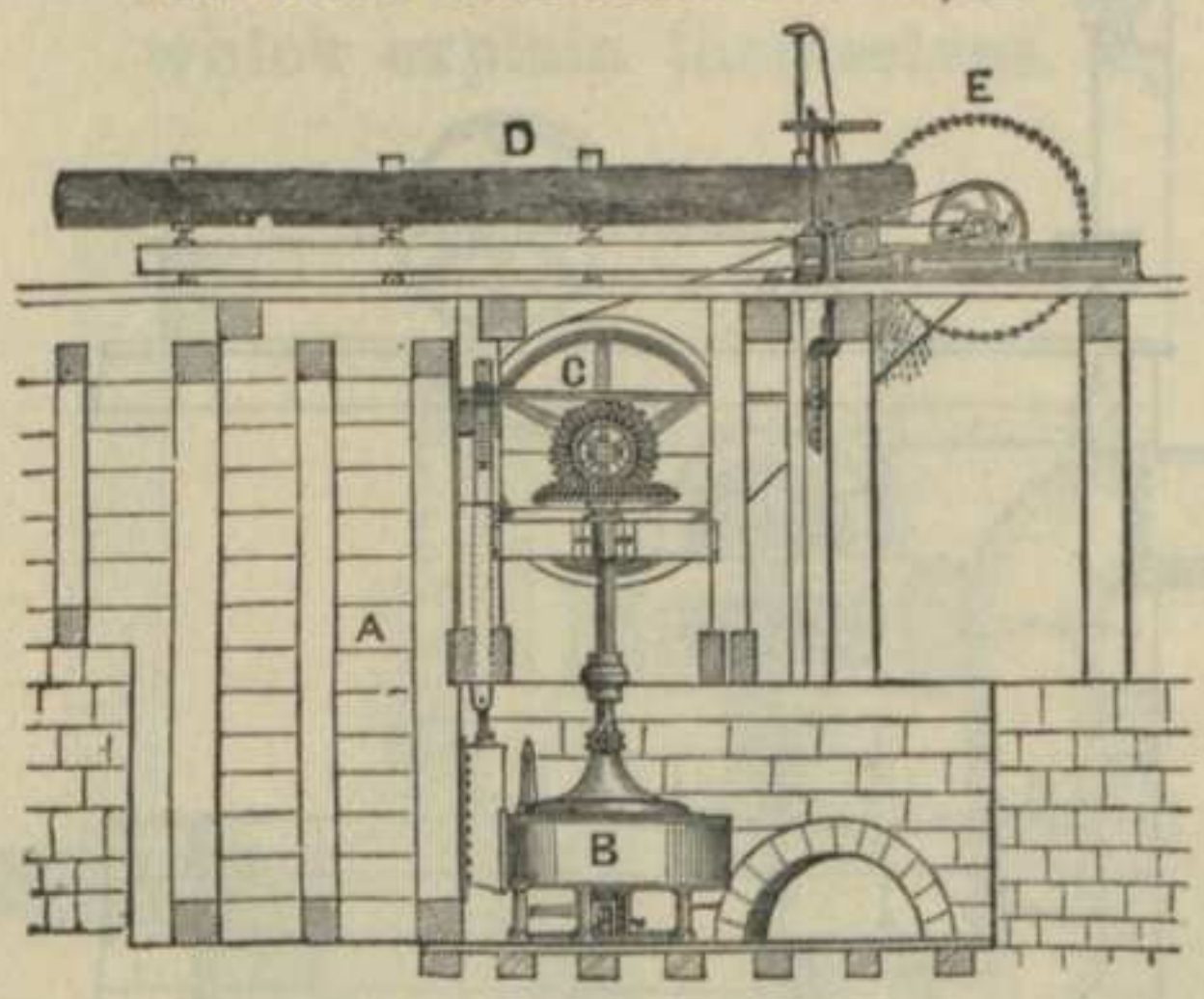
The crank-shaft of saw is driven from water-wheel counter-shaft, by means of a belt, the power being taken from the water-wheel shaft by the mitre gears. We also set our wheels so as to gear directly on to the crank-shaft, when it can be done easily.

B is the wheel and manner of setting; **C**, the gears and driving pulley; **D**, the crank-wheel, pulley, and pitman; **E**, the saw and frame, and **F** the feed works.

There is no other wheel in the world so well adapted to the rough work of saw-mills. Its great simplicity, freedom from clogging, durability, and non-freezing qualities, especially recommend it for this kind of service, and as a consequence, we have sold large numbers of wheels for saw-mills.

Double Wheel can be set in the same manner.

DRIVING CIRCULAR SAW-MILL.



Description of Cut.

This cut shows a manner of gearing "Perfection" wheels to drive circular saw mills that is largely used, and is the best arrangement for large and medium size wheels. Power is taken off of wheel by bevel gears on to a line shaft carrying a good heavy pulley that serves as a fly wheel, and from this pulley is belted to pulley on saw mandrel.

The penstock leading water to the wheel is such as is frequently used for flume wheels. We show it because many "Perfection" wheels are sold to replace flume wheels, and this shows how the old penstock can be utilized in many cases. It also makes a very good arrangement even for a new one, and is often built by millwrights for "Perfection" wheels.

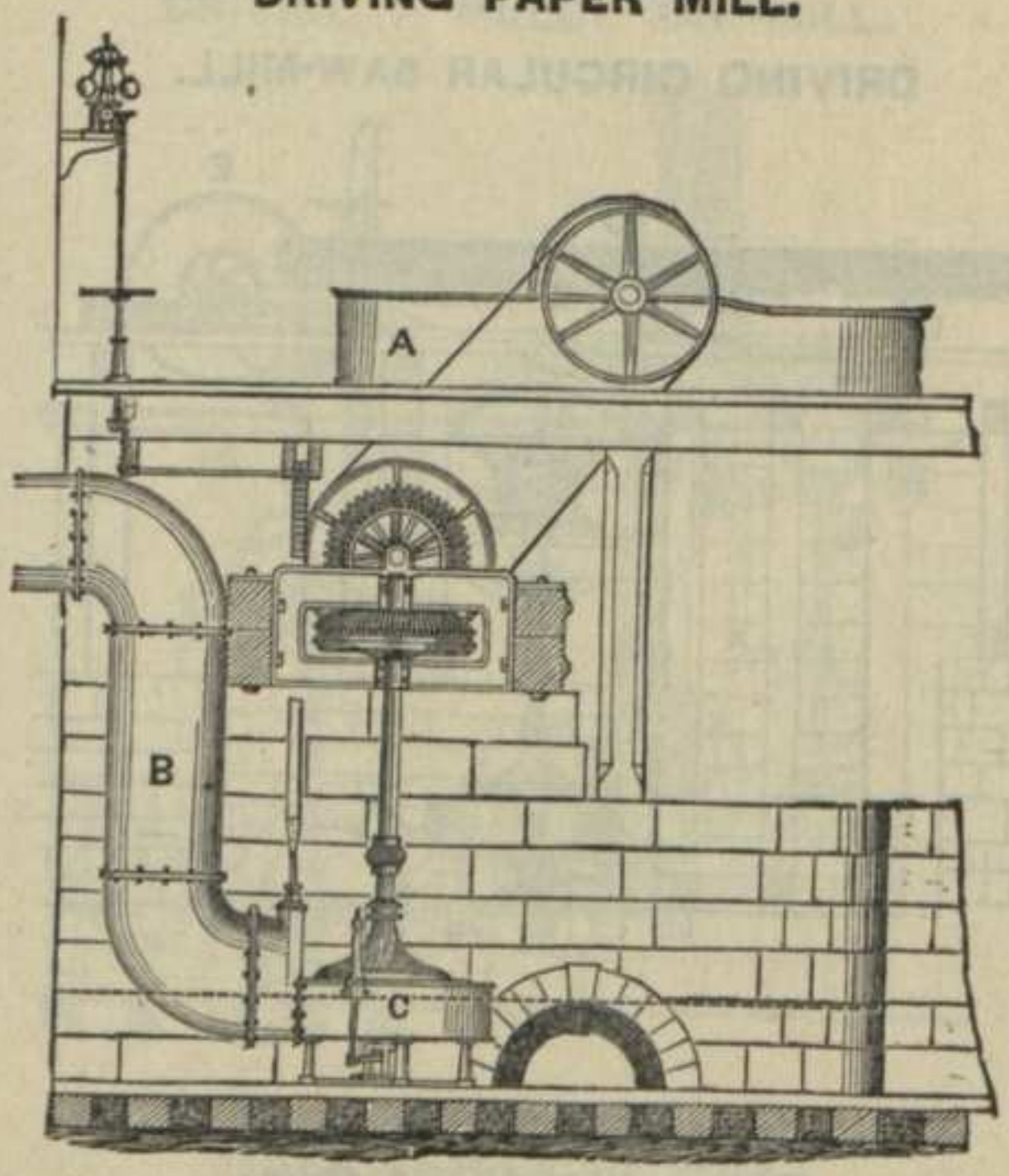
There is no water-wheel in the world so well adapted for saw mills as the "Perfection." It never gets out of order, or clogs with chips, rubbish, etc., so bothersome to saw mills, and there is no situation where they cannot be used. As a consequence we have sold a large number for saw mills, and all are giving the most perfect satisfaction.

Our circular saw mills are especially designed to be driven by water power, and are good and cheap.

The gate is moved by rack and pinion, and bevel wheels, as shown, run to any point convenient to sawyer.

Double "Perfections" can be set in the same manner.

DRIVING PAPER MILL.

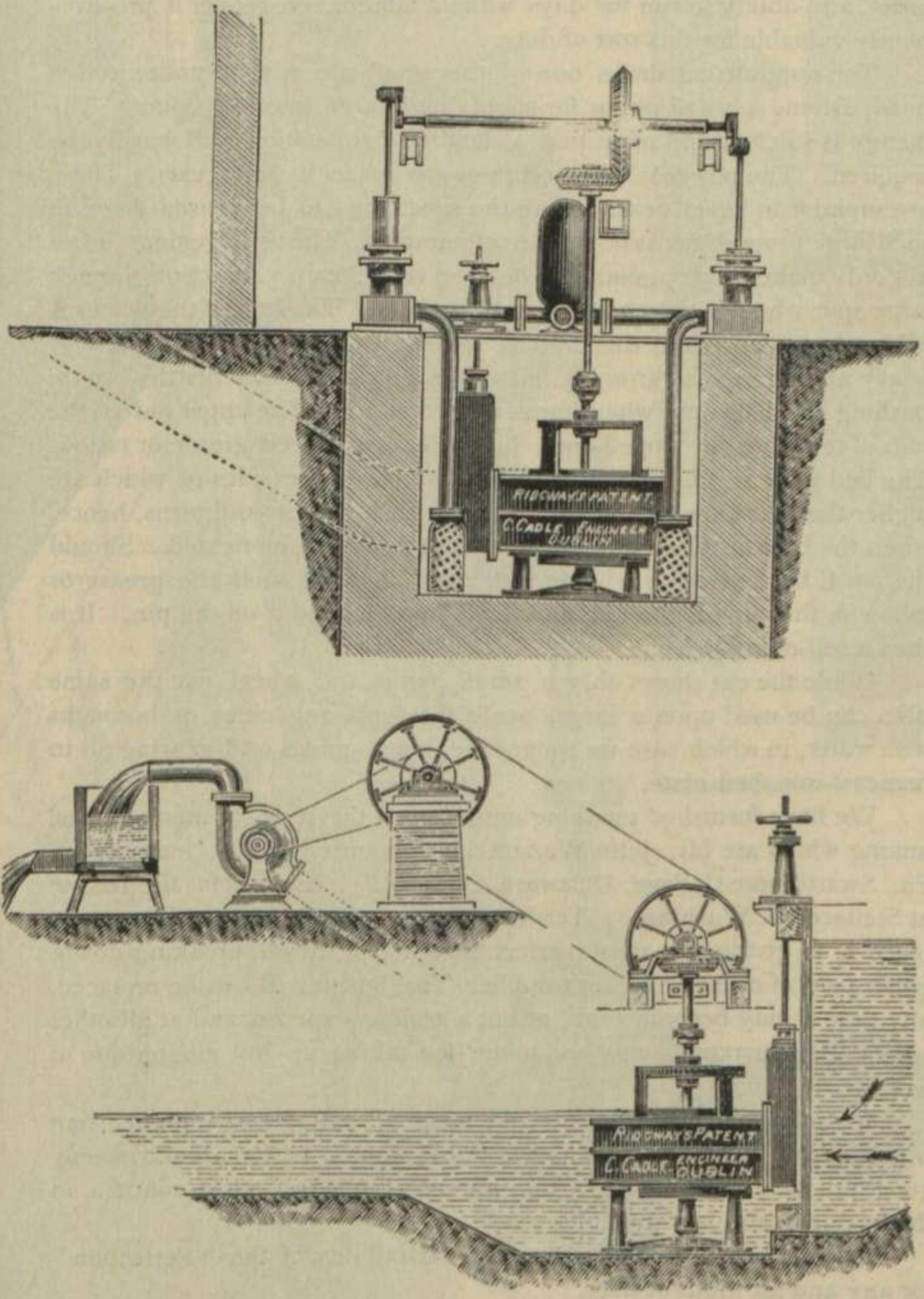


Description of Cut.

This outline sketch shows a manner of using cast iron pipe with two quarter turns instead of running straight to the wheel. The wheel shown is a 36 inch wheel under 28 feet head, driving a paper mill. The diameter of pipe is 48 inches. We advise the use of wrought iron for so large a pipe, as it can be made cheaper. However, the manner of setting is made clear. The power is taken off from wheel by means of bevel gears with iron and wood cogs. The shaft of water-wheel and the line shaft are carried on a strong cast iron frame, which firmly secures them in their relative positions. This manner of taking off the power of a wheel is one largely employed to connect to a line shaft. The gate is drawn by a rack and pinion, the shaft of the latter being geared to an upright shaft carrying hand-wheel and a governor. The wheel is set upon a strong sheeting laid on good stout timbers. The dotted line shows level of tail-water when gate is fully drawn. This sketch is so made that it may be fully understood without much explanation. The bends were used in this case instead of running pipe on an angle direct on account of the ground being very rocky, and the impossibility of setting the wheel any farther from the wall.

Double Wheel can be set in the same manner

Some Cuts from Circular of our Foreign Agent, which explain themselves.



Driving Water Works.

No water-wheel yet made is so well adapted for the work of driving pumps as the "Perfection." Its great simplicity, its never getting out of order, and ability to run for days without attendance, render it pre-eminently valuable for this sort of duty.

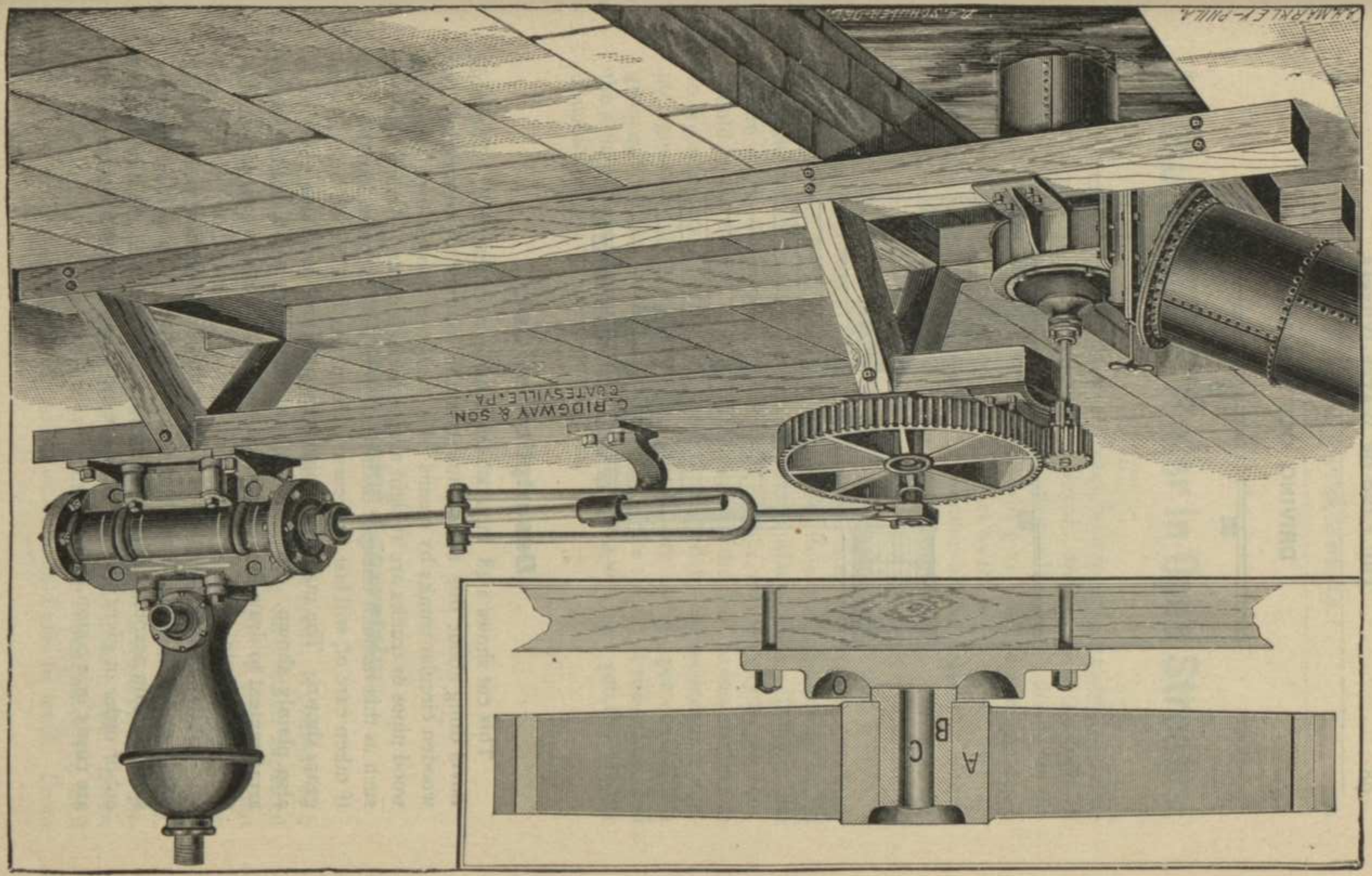
The opposite cut shows one of the small-size wheels under a high head, driving a small pump for supplying a large insane asylum. The picture is so clear and plain that a detailed explanation will hardly be required. The power is taken off the water-wheel by spur gears. These are superior to bevel gears where the speed has to be geared down in such large proportions as in the case of pumping. The arrangement shown not only makes a very good one but also very cheap. A section through large spur wheel is shown in the upper corner. The hub of the wheel **A** is bored out, and into this hub is secured the bronze bushing **B**. A heavy and strong cast-iron bed plate **O** has a pin **C** which fits the bronze bushing **B**. The spur wheel turns upon this pin. The upper part of the hub of the wheel is cupped out. In this cup is placed grease or tallow. The bed plate is also cupped out to form a basin, the sides of which are higher than the shoulder, where the brass bushing rests and turns, hence, when the basin is filled with oil, this point is always lubricated. Should the pin **C** become dry it will get warm and this will melt the grease or tallow in the cup on the hub and it will run down and oil the pin. It is thus a self-oiling journal.

While the cut shows only a small pump and wheel, yet the same plan can be used upon a larger scale for supplying cities or boroughs with water, in which case we mount the pump, guides and gearing all in one cast-iron bed plate.

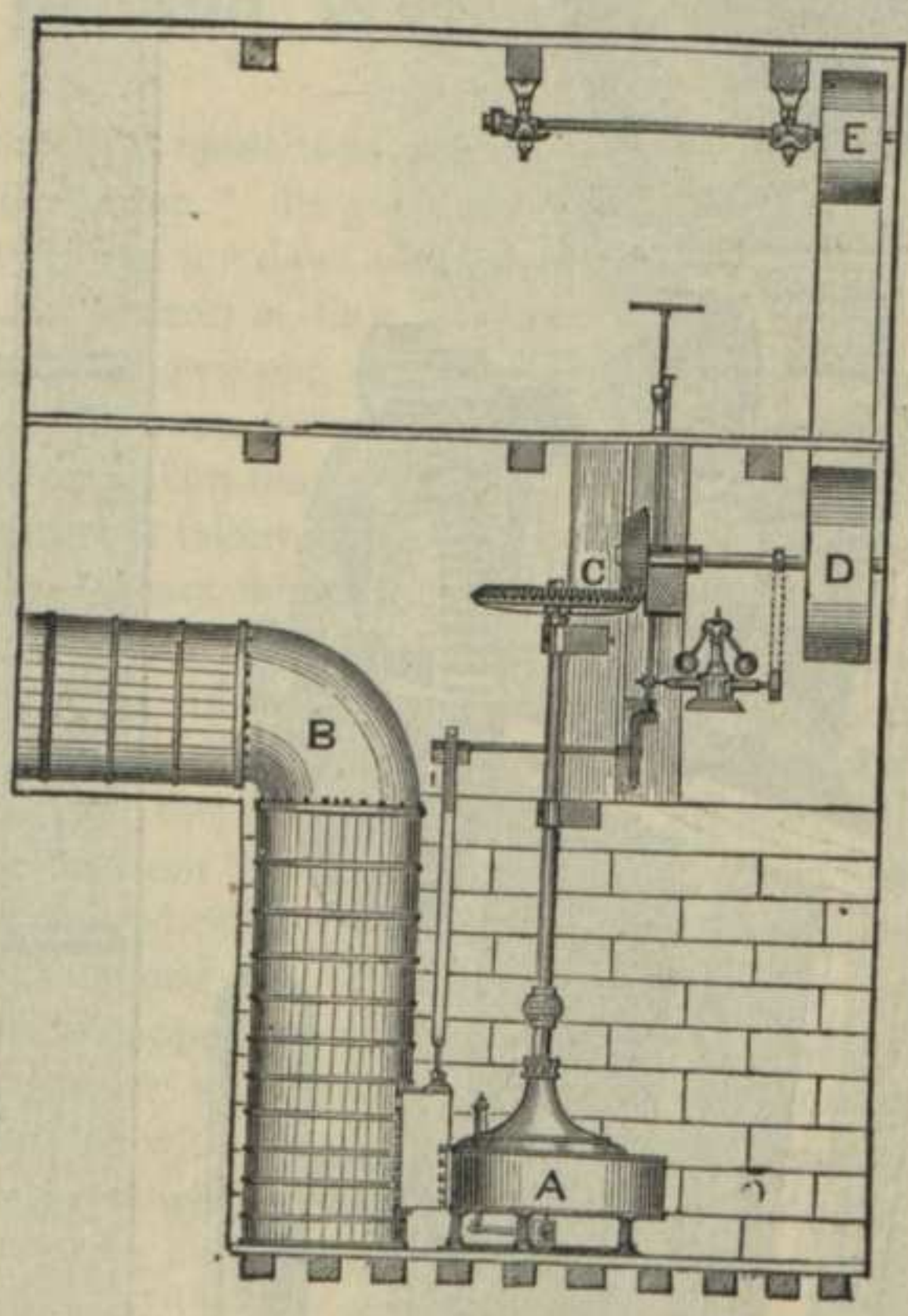
We have furnished pumping outfits, upon this style for many places, among which are Mr. John Wanamaker's country seat at Jenkintown, Pa., Swarthmore College, Delaware County, Pa., Asylum for the Insane at Steilacoom, Washington Territory, and many others, and in every place it is giving the most perfect satisfaction, never breaking down, getting out of order or giving trouble. The bushing **B** can be replaced, any time it may become worn, at but a trifling expense, and at all other points ample arrangements are made for taking up lost motion due to wear.

We solicit an opportunity to bid upon all water-works, plant using water as the motive power, as we think we are better able to supply good, practical machinery for this purpose than any other concern in the business, and at a much less cost.

This cut but further illustrates the adaptibility of the "Perfection" for any and all kinds of duty.


C. RIDGWAY & SON.
GATESVILLE, PA.
A
B
C
D

DRIVING COTTON MILL.



Description of Cut.

This cut shows a 48 inch wheel driving a cotton mill. The only novel thing about this arrangement is the manner of connecting two wooden circular trunks by means of a cast-iron quarter-turn when the wood pipes or trunks are at right angles to each other. An arrangement such as this is much cheaper than if all iron, and is quite durable, and if taken care of, will last for years. The power is taken off by the bevel gears shown. The manner of operating gate and attaching governor is also plainly shown. In practice now, however, we furnish a screw arrangement to draw the gate, which makes it work much easier than the rack and pinion.

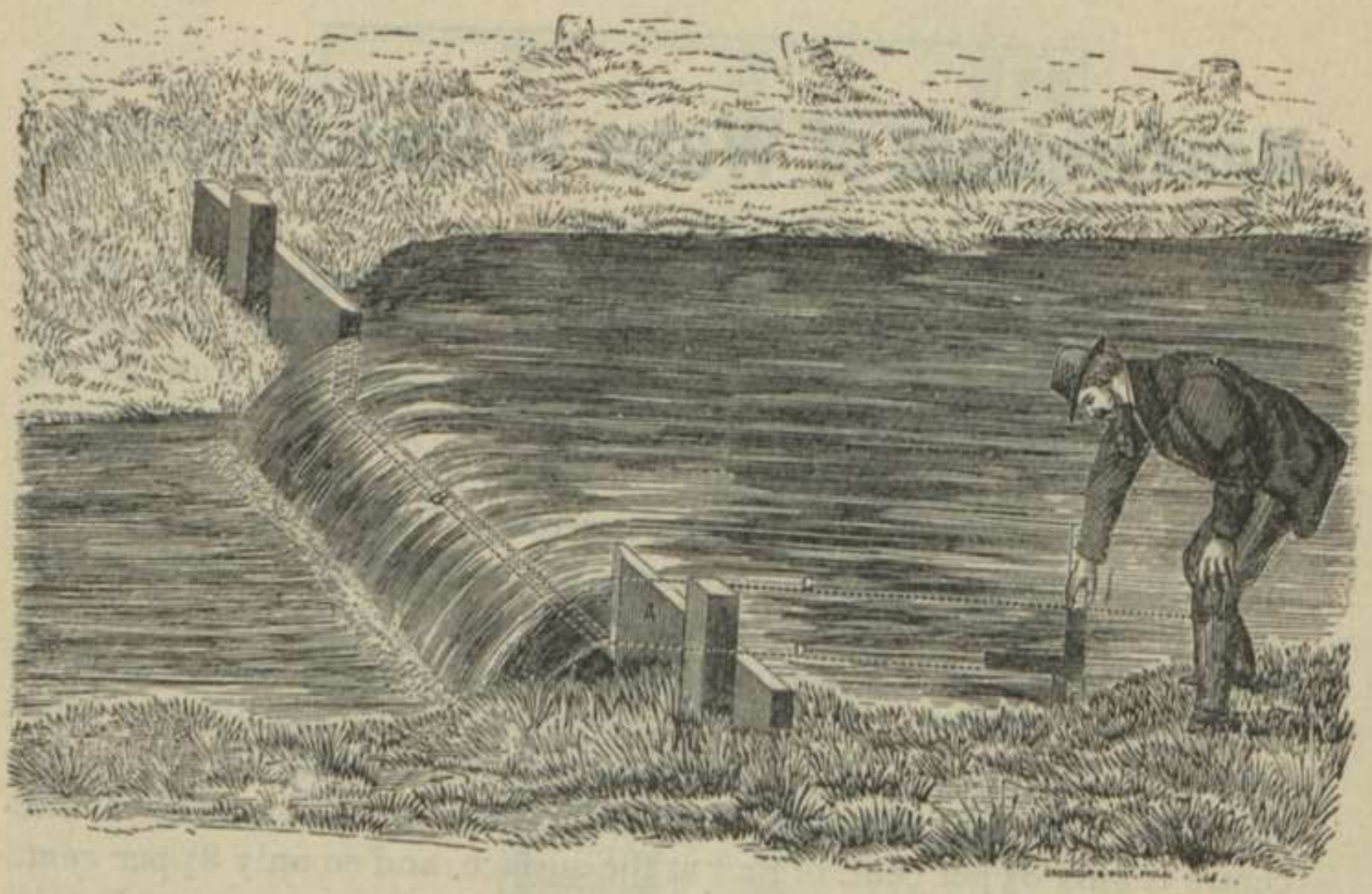
We have a large number of "Perfection" wheels now in use driving cotton mills, all giving their users great pleasure. It is well adapted for such mills on account of its great steadiness of motion. As it never gets out of order or gives trouble, there are no stoppages and delays, which are costly in a cotton mill.

Measurement of Water in Open Streams.

To measure water in an open stream, take from four to twelve different points in a straight line across the stream, and measure the depth in feet at each of these points, and adding them all together divide by the number of measurements taken. This will give you the average depth in feet. Multiply this average depth in feet by the width in feet, and this will give you the square feet of cross-section of the stream. Multiply this by the velocity of stream in feet per minute, and you will have the cubic feet per minute in the stream. The velocity of the stream can be found by laying off 100 feet on the bank, and then throwing a piece of board into the stream at the middle, note the time passing over the hundred feet, and dividing the 100 feet by the time and multiplying by 60 gives the velocity in feet per minute at the surface. The velocity at the centre is only 83 per cent. of that at the surface, and so only 83 per cent. should be calculated. For example, suppose the float passes 100 feet in 10 seconds, then divided by 10 and multiplied by 60 (seconds in a minute) gives 600 feet per minute, as the velocity and 83 per cent. of this gives 498 feet per minute, as the velocity of the stream at the centre, and the area of the cross-section multiplied by this will give you the number of cubic feet per minute in the stream.

To Measure Water Accurately.

To measure water accurately a weir must be used. It consists of a board with a notch made in it (see accompanying cut), which is placed in some narrow part of the stream and used as a dam. It must be so put in that no water can leak past it, as all the water must pass through the notch. This notch must be deep enough to pass all the water, and should not be more than two-thirds of the width of stream in length. The edges of notch, both bottom and sides, should be beveled on *the down-stream side* to within an eighth of an inch of the up-stream side. About two or three feet up stream from the notch a stake should be driven until ts top is exactly level with the notch, which should also be level. From



the top of this stake the depth of water on the weir can be measured. When this depth is known, the quantity of water in cubic feet per minute can be accurately determined by referring to the accompanying weir table, which gives the number of cubic feet per minute for different depths for each inch or width of notch. The depths are given in inches and eighths of an inch. The first column of table is the full inches, and the top line the eighths. The following example shows how the amount is found. Suppose the notch is 20 inches wide, and depth of water measured over the stake is 5⅝ inches. Follow down first column till you come to 5, and then run across until under ⅝ and you find 5.338, which is the cubic feet per mirute for one inch of width, and multiplying this by 20, the number of inches wide, equals 106.60 cubic feet per minute. Suppose, now, you have 25 foot head, and you would like enough power to drive a pair of stones. By consulting the tables you find a 10 inch wheel will give you the proper horse-power, but it requires 195 cubic feet, while your stream has only 106. But you have a dam, and as you only expect to run in day-time, you can store your water, and so put in a wheel that will give you power enough, although it does use nearly double the amount of water. We make this point here, because parties are misled when measuring their water by forgetting this benefit of the dam Now, while this whole method is simple, we would like parties to give us the depth and width of weir, so we can make the calculations for ourselves; and state also what length of time the water can be dammed or held if the stream is small.

Table of Weirs.

In.	0	1/8	1/4	3/8	1/2	5/8	3/4	7/8
1	0.403	0.408	0.563	0.649	0.740	0.835	0.966	1.035
2	1.141	1.248	1.360	1.475	1.593	1.714	1.838	1.964
3	2.094	2.121	2.361	2.599	2.639	2.782	2.927	3.062
4	3.225	3.337	3.531	3.688	3.848	4.009	4.173	4.339
5	4.506	4.676	4.849	5.023	5.200	5.378	5.558	5.740
6	5.925	6.105	6.298	6.488	6.681	6.874	7.071	7.266
7	7.465	7.666	7.869	8.073	8.280	8.487	8.697	8.908
8	9.121	9.335	9.552	9.770	9.990	10.211	10.427	10.657
9	10.884	11.111	11.340	11.571	11.804	12.037	12.272	12.509
10	12.747	13.147	13.228	13.471	13.716	13.961	14.208	14.457
11	14.707	14.957	15.211	15.465	15.721	15.978	16.236	16.495
12	16.757	16.206	17.283	17.549	17.816	18.083	18.352	18.622
13	18.895	19.167	19.445	19.718	19.996	20.274	20.558	20.834
14	21.116	21.400	21.684	21.970	22.258	22.546	22.835	23.127
15	23.418	23.708	24.007	24.302	24.600	24.897	25.195	25.496
16	25.800	26.102	26.406	26.712	27.019	27.325	27.634	27.943
17	28.256	28.566	28.881	29.195	29.512	29.829	30.145	30.464
18	30.785	31.106	31.429	31.752	32.075	32.403	32.733	33.055

To Measure Water on Wooden Wheels,
or Through an Aperture.

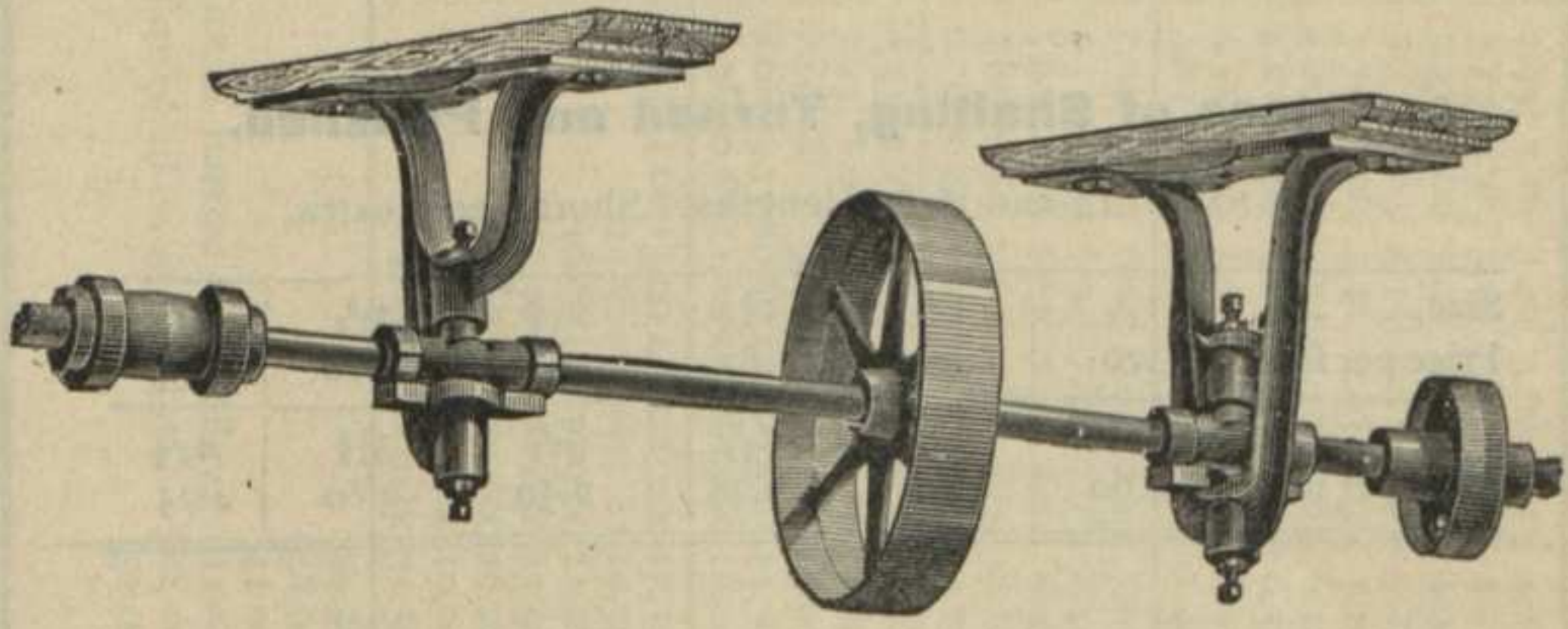
When an overshot, breast, or undershot wheel is used, or when the water passes through an opening under a head, the quantity may be found from the annexed table. In this case, the edges of the opening should be square, and they generally are. The distance from the centre of the opening to level of head water is the head. To find the quantity of water, multiply the width of opening to let water on the wheel by the height the gate is raised, and this gives the area of the opening; multiply this area by the discharge due the head. The table is applied as follows. Suppose the opening to let the water on to an overshot is 48 inches wide, and the gate is raised 3 inches, and the head from centre of opening to the level of head water is 28 inches. The first column is the head in inches. The second column is the cubic feet discharged per minute for each square inch of opening. In the above case, the area of the opening is 48x3=144 square inches. Under 28 inch head we find in the discharge column a square inch of opening discharges 3.24 cubic feet per minute, and 144 square inches will discharge 144x3.24=456.55 cubic feet. Under a 28 feet head, one 16 inch wheel will use this amount of water.

Discharge through Apertures.

Height of head in inches to centre of aperture.	No. of cubic ft. to one square inch.	Height of head in inches to centre of aperture.	No. of cubic ft. to one square inch.	Height of head in inches to centre of aperture.	No. of cubic ft. to one square inch.	Height of head in inches to centre of aperture.	No. of cubic ft. to one square inch.	Height of head in inches to centre of aperture.	No. of cubic ft. to one square inch.
2	.86	12	2.250	22	3.046	32	3.669	42	4.209
3	1.16	13	2.342	23	3.115	33	3.731	43	4.259
4	1.22	14	2.430	24	3.182	34	3.784	44	4.304
5	1.37	15	2.515	25	3.248	35	3.842	45	4.357
6	1.50	16	2.598	26	3.312	36	3.897	46	4.403
7	1.62	17	2.678	27	3.375	37	3.950	47	4.454
8	1.73	18	2.755	28	3.434	38	4.004	48	4.500
9	1.84	19	2.831	29	3.497	39	4.056	49	4.561
10	1.94	20	2.904	30	3.557	40	4.105	50	4.593
11	2.04	21	2.972	31	3.616	41	4.159	51	4.638

Racks.

We have said nothing about racks heretofore in this book, but we suppose every man would have sense enough to put a rack in his head-race. The bars should be from ¾ to 1 inch apart, and should be placed at an angle of about 45 degrees. If the stream is very dirty it is well to put in two racks—the first a coarse one and the second a finer one. The bars of the racks can be either wood or iron. Of course, iron is the best, especially for small wheels, as they don't take up so much room. We make nice cast-iron bars for the purpose when parties want them, which are not costly and very handy to clean. The forebay below the rack toward wheel should always be covered to keep any mischievously inclined person from throwing in stones or sticks that might injure the wheel.



Gearing, Shafting, Pulleys and Boxes.

Many a good turbine has been killed by the shafting and gears used to transmit its power. We like to furnish these when parties order wheels for then we know they are right. We make as low prices as any one for good work. With bevel gears too great pains cannot be taken as 25 per cent. and over are oftentimes lost by imperfect gears. We have at great expense prepared a great many patterns especially for "Perfection" wheels as it is to our interest to always have our wheels do their very best. Parties getting "Perfection" wheels should always have us to furnish the gearing. Our pillow or clamp boxes are not the cheap ordinary things filled with the commonest babbitt, but good strong flat base pedestal boxes, filled with the best anti-friction metal, which are *scraped* and well and correctly fitted to the shaft that is to run in them. Our shafting is prepared with great care and our pulleys are strong and perfectly balanced. Too great pains cannot be taken with these things and when we make them ourselves we know they are right, and if wheels do not do well we can blame no one else.

We make spindles, steps, binder pulleys, pulley plates, hangers, gudgeons, bushes, in fact everything of the kind used about a mill and all of the very best. Send us a list of such things as you need and we will name you the lowest possible prices for first-class work. We will not make "slop-shop" work for any one, especially for to go with our wheels. It always pays to get the best and we make the best at low prices. *"What is worth doing at all is worth doing well."*

Below we give the list prices of shafting, etc., and parties should send us a list of what they need, and we will name lowest market rates.

Prices of Shafting, Turned and Polished.

In 10, 12, 14 and 16 feet lengths. Short pieces extra.

Size, .	1 7/16	1 9/16	1 11/16	1 15/16	2 3/16	2 7/16
Price per foot,	.76	.80	.87	.98	1.10	1.35
Size, .	2 11/16	2 15/16	3 3/16	3 7/16	3 15/16	4 7/16
Price per foot,	1.60	1.90	2.28	2.50	3.60	4.75

Plate Couplings.

Size, .	1 7/16	1 9/16	1 11/16	1 15/16	2 3/16	2 7/16
Price per pair,	5.00	5.50	6.00	8.00	8.75	10.75
Size, .	2 11/16	2 15/16	3 3/16	3 7/16	3 15/16	4 7/16
Price per pair,	13.00	15.25	20.00	23.00	26.00	39.00

Flat Base Clamp Boxes.

With the best babbitt and bolts for 10 inch wood.

Size, .	1 7/16	1 9/16	1 11/16	1 15/16	2 3/16	2 7/16
Price each,	1.80	2.00	2.64	3.00	4.00	4.80
Size, .	2 11/16	2 15/16	3 3/16	3 7/16	3 15/16	4 7/16
Price each,	5.64	6.78	7.40	8.88	11.40	15.00

Loose Collars.

Size, .	1 7/16	1 9/16	1 11/16	1 15/16	2 3/16	2 7/16
Price each,	1.15	1.18	1.25	1.50	1.85	1.95
Size, .	2 11/16	2 15/16	3 3/16	3 7/16	3 15/16	4 7/16
Price each,	2.20	2.75	3.20	3.40	3.85	4.75

Price List of Pulleys.

The extreme right and left hand columns give the diameter of pulleys, and the top and bottom lines the width of faces. In looking for price of pulley, say 34 diameter, 12 inch face, find 34 in left hand column, and then run across until under 12 width of face, and you will find $20.50, which is price without the discount.

DIAMETERS.

	WIDTH OF FACES.																		
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	22	24
12	2.70	2.93	3.16	3.40	3.66	3.93	4.20	4.46	4.73	5.00				Price of smaller pulleys than 12 in. furnished on application.					
13	2.87	3.13	3.38	3.65	3.95	4.26	4.57	4.87	5.18	5.50	5.85								
14	3.04	3.33	3.60	3.90	4.24	4.59	4.94	5.29	5.64	6.00	6.36	6.75							
15	3.22	3.53	3.83	4.15	4.53	4.92	5.22	5.71	6.10	6.50	6.95	7.80	9.25						
16	3.40	3.73	4.06	4.40	4.83	5.36	5.70	6.13	6.56	7.00	7.80	8.60	10.00	11.50					
17	3.65	4.00	4.36	4.72	5.18	5.65	6.12	6.59	7.07	7.55	8.37	9.20	10.75	12.37	14.50				
18	3.90	4.27	4.66	5.04	5.54	6.04	6.54	7.06	7.58	8.10	8.94	9.80	11.50	13.24	15.75	19.00			
19	4.15	4.55	4.96	5.37	5.90	6.43	6.97	7.53	8.09	8.65	9.52	10.40	12.25	14.12	17.00	20.00			
20	4.40	4.83	5.26	5.70	6.26	6.83	7.40	8.00	8.60	9.20	10.10	11.00	13.00	15.00	18.00	21.00	27.00		
21	4.62	5.09	5.55	6.02	6.65	7.29	7.92	8.58	9.24	9.90	10.90	11.87	13.90	15.95	19.00	22.00	28.00		
22	4.85	5.35	5.84	6.34	7.04	7.75	8.44	9.16	9.88	10.60	11.70	12.74	14.30	16.90	20.00	23.00	29.00	35.00	
23	5.08	5.61	6.13	6.67	7.43	8.21	8.97	9.74	10.52	11.30	12.50	13.60	15.70	17.85	21.00	24.00	30.00	36.50	
24	5.30	5.86	6.43	7.00	7.83	8.66	9.50	10.33	11.16	12.00	13.25	14.50	16.65	18.80	22.00	25.00	31.00	38.00	46.00
25	5.60	6.20	6.80	7.40	8.30	9.20	10.10	11.00	11.85	12.70	14.52	16.34	18.16	20.00	23.05	26.10	32.20	39.90	47.50
26	5.90	6.53	7.16	7.80	8.76	9.73	10.70	11.63	12.56	13.50	15.40	17.30	19.20	21.10	24.20	27.30	33.40	41.50	49.00
28	6.45	7.23	8.00	8.70	9.73	10.76	11.80	12.86	13.92	15.00	17.05	19.10	21.15	23.20	26.35	29.50	35.80	44.00	52.00
30	7.00	7.86	8.73	9.60	10.73	11.86	13.00	14.16	15.23	16.50	18.25	20.00	22.75	25.50	28.60	31.80	38.00	46.60	55.00
32	7.60	8.66	9.73	10.80	12.00	13.25	14.50	15.83	17.16	18.50	20.90	23.30	25.70	28.00	31.10	34.00	40.70	49.30	58.00
34	8.30	9.46	10.63	11.80	13.20	14.60	16.00	17.50	19.00	20.50	23.00	25.50	28.00	30.50	33.70	36.20	43.40	52.20	61.00
36	9.00	10.33	11.66	13.00	14.50	16.00	17.50	19.15	20.80	22.50	24.75	27.00	30.00	33.00	36.25	38.50	46.00	55.00	64.00
38				14.50	16.16	17.82	19.50	21.30	23.10	25.00	27.80	30.10	33.40	36.00	39.00	42.00	49.00	58.00	68.00
40				16.00	17.83	19.66	21.50	23.50	25.50	27.50	30.40	33.30	36.20	39.00	42.00	46.00	52.00	62.00	72.00
42				17.50	19.50	21.50	23.50	25.50	27.50	30.00	33.00	36.00	39.00	42.00	45.00	49.00	55.00	65.00	76.00
44				19.60	21.80	24.00	26.20	28.50	30.80	33.00	36.70	40.40	43.00	46.00	49.00	53.00	59.00	69.00	80.00
46				21.80	24.20	26.60	19.00	31.50	34.00	36.50	39.90	43.30	46.70	50.00	53.00	57.00	63.00	73.00	84.00
48				24.00	26.50	29.00	31.50	34.00	37.00	40.00	43.50	47.00	50.50	54.00	58.00	61.00	68.00	78.00	89.00
50							34.50	37.70	40.90	44.00	47.50	51.00	54.50	58.00	62.00	66.00	73.00	83.00	94.00
52							38.00	41.30	44.10	48.00	51.75	55.50	59.25	63.00	67.00	71.00	79.00	89.00	100.00
54							41.00	44.00	48.00	52.00	56.00	60.00	64.00	68.00	72.00	76.00	85.00	95.00	106.00
56							44.00	48.00	52.00	56.00	60.50	65.00	69.50	73.00	78.00	82.00	91.00	101.00	112.00
58							48.00	52.00	56.00	60.00	64.00	69.00	74.00	79.00	84.00	88.00	98.00	108.00	118.00
60							52.00	56.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	105.00	115.00	125.00
66										80.00	85.00	91.00	97.00	103.00	109.00	115.00	127.00	138.00	150.00
72										95.00	101.00	108.00	115.00	122.00	129.00	136.00	150.00	164.00	180.00
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	22	24

Price of narrow face pulleys furnished on application.

WIDTH OF FACES.

DIAMETERS.

BETTER THAN TALK.

Agents and makers of rival water-wheels in their envy of our great success, unprecedented in water-wheel history, have a great deal to say against the Double "Perfection," because it has but a single opening, instead of a dozen or more, like other wheels. Talk is cheap. If the "Perfection" was not the best of wheels, we would not be selling them by increasing hundreds every year. A poor wheel soon condemns itself and disappears. The truth is, the same man who runs it down would talk the other way if we paid big commissions to agents. The only poor or faulty thing about the "Perfection" is this matter of commissions.

We believe, however, in letting the "Perfection" do its own talking and be its own agent. Rather than employ men to run the country and argue the matter, we propose the following test with any other turbine: the understanding upon our part to be that, *should the "Perfection" fail to excel its competitor, we forfeit our wheel.*

The test shall be upon the following points, which we believe to be the vital and most desirable features in a water-wheel.

1. Efficiency at full gate opening.
2. Efficiency at three-quarters gate.
3. Efficiency at one-half gate.
4. Regularity of speed at these different gateages.
5. Tightness of gate.
6. Liability to clog with leaves, grass and other rubbish.
7. Simplicity of construction.
8. Cheapness of setting and ease of access.
9. Durability and freedom from wear.
10. Strength and excellence of construction.

Manner of Test.

The test shall be conducted as nearly as possible in the following manner. Three judges shall be selected, one by the competing wheel people, one by ourselves, and one by the mill owner. The wheels shall be as near as possible of the same horse-power and, if possible, set side by side in the mill. The wheels to be set and looked after by their respective builders or their representatives.

Test for Efficiency and Regularity of Speed.

A weir shall be erected in the tail race, over which the water shall be measured. The power is to be noted either by dynamometer, when one is to be had, or by quantity and quality of work done in a stated time. The first test shall be with gate wide open, and with all the water that will pass through the wheel. The second test shall be by throttling the water until there is passing over the weir three-quarters of the full amount, and then measuring the work done. The third test shall be by throttling the water to one-half, and then measuring the work done. While these tests are in progress, a speed indicator is to be attached to the upright water-wheel shafts and all variation in speed noted. The wheel showing the best result shall be so credited in the manner hereinafter explained.

Test for Tightness of Gate.

The water shall be baled out of the tail race, and all water leaking past the closed gates of each wheel caught and measured. This test can be made in any way the judges may desire. As our gate is absolutely tight, it makes no difference to us how this test is made.

Clogging with Rubbish.

Two or three or more cart-loads of rubbish and trash shall be collected and dumped into the forebay, so it will pass through the wheels and the results on the wheels noted. The judges shall decide which wheel is easiest clogged and declare its competitor the winner.

Simplicity of Construction.

This will have to be decided by the judges taking wheels apart and examining their construction.

Cheapness of Setting and Ease of Access.

This will also have to be decided by the judges after considering the matter.

Durability and Freedom from Wear.

This test shall be made by starting wheels, and then from time to time dump mud, gravel and sharp sand into the forebay, and thoroughly mix it with the water, so that this gritty stuff shall come in contact with every part of the wheels and their bearings that are within reach of the water. This is to be done while all the tests are being made on wheels, and continued as long as possible. At end of all the tests the wheels are to be examined, and that wheel showing all absence of or the least amount of wear, shall be credited as the victor on this point. This test is an effort to produce the effects of muddy and gritty streams, and to show the advantage of the "Perfection," whose bearings are entirely out of the reach of the water.

Strength of Construction.

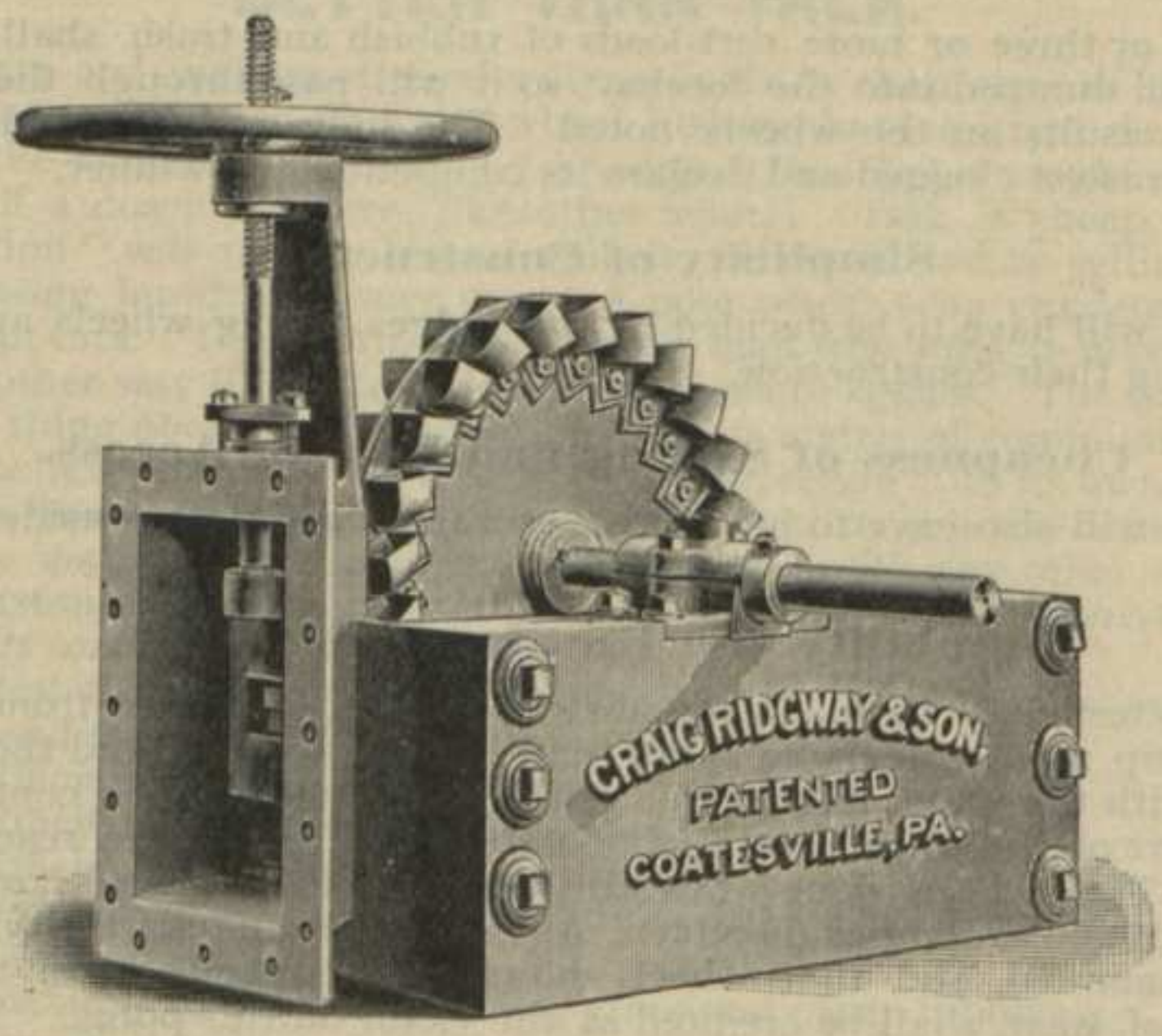
This test is a cruel one to most wheels, but as it is simply producing an accident that is liable to happen to every wheel, sooner or later, we insist upon its being made. The "Perfection" is designed to stand such mishaps, and we are not afraid to subject it to them. While a mill owner wants an efficient wheel, he also wants one that will stand hard usage. The judges shall prepare a number of hickory or oak sticks, from 3 to 4 inches wide and from ¾ to 1½ inches thick, according to size of wheel. They may be one, two or three feet long. These are to be thrown into the forebay and sunk and made to pass into the wheels while they are running at full speed. That wheel which shall go through this ordeal unhurt, or the least damaged, shall be declared the winner in this test.

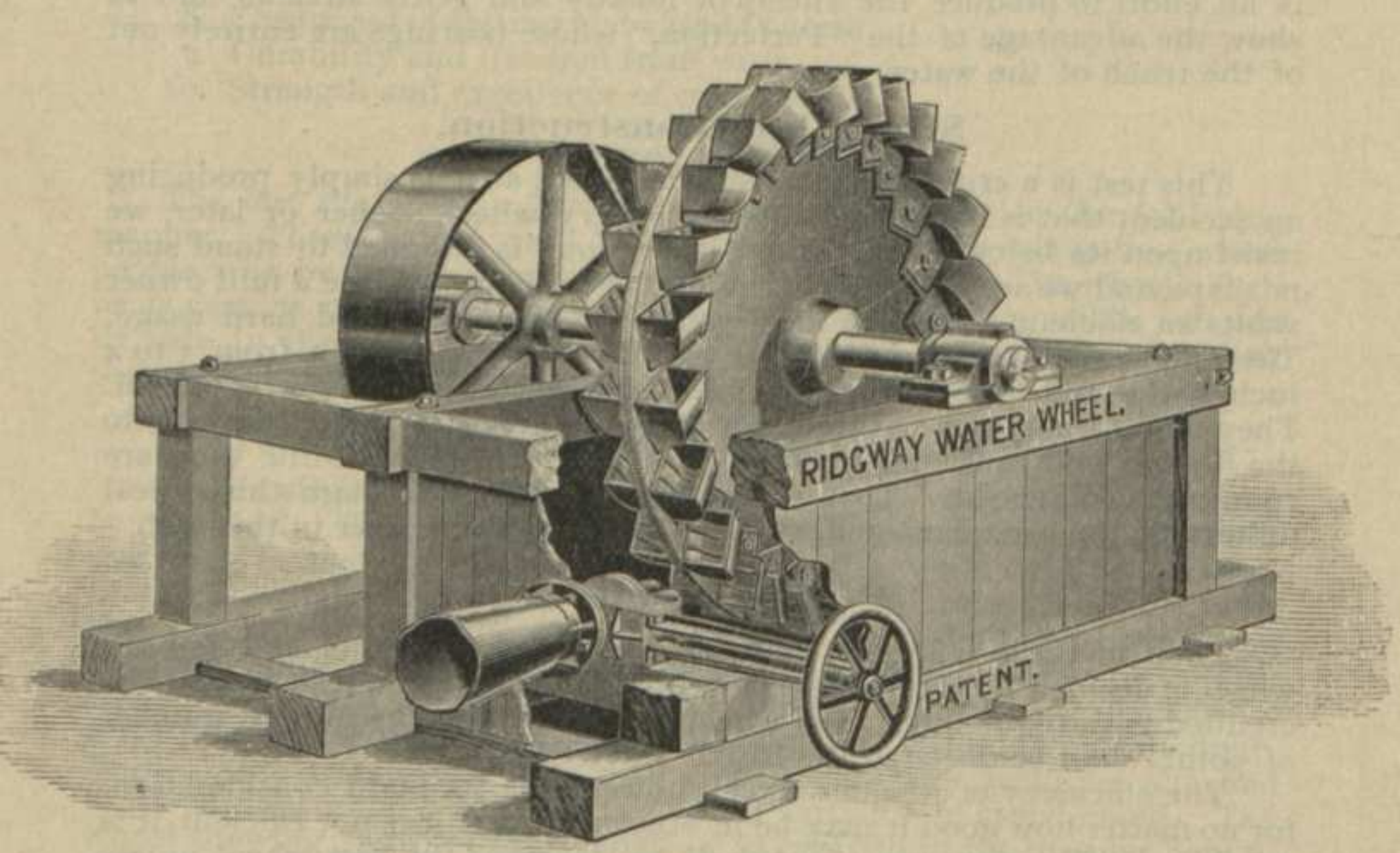
The Count.

Each of these ten tests shall be considered 10 points, and as each wheel is decided by the judges as being the winner in a test, it shall be credited with ten points. The wheel that shall have the highest number of points shall be declared the BEST WHEEL.

The efficiency of a water-wheel, however, is its main consideration, for no matter how good it may be in other points, if it is not efficient, it is worthless. Therefore, no wheel shall be declared the best wheel unless it shall be the winner in at least one of the first three tests, in addition to a majority of the others.

The mill owner shall purchase the winning wheel at a price that may have been previously agreed upon between him and its builder or agent. Should the "Perfection" be beaten, it is made a present to the mill owner, and he can do with it as he pleases, either keep it or sell it back to us. The losing wheel pays all expenses of the test.





The above cut shows two different styles of our Double Jet water-wheels. These wheels are only intended for very high heads. For such situations, they are far superior to the turbine, and hundreds of them are used. Special circulars of these wheels will be sent on application.

Speeds and Powers.

Speed of Stones.—For 3 feet stones, 230 to 250 revolutions per minute.

3½"	"	200	"	"	"
4 "	"	180	"	"	"
4½"	"	160	"	"	"
Bolting reels		30 to 39	"	"	"
Conveyors for flour,		35 " 40	"	"	"
"	" wheat,	45 " 50	"	"	"
Elevators,		30 " 35	"	"	"

Circular Saws.—

36 inch saw,		650 " 700	"	"	"
40 "	"	600 " 650	"	"	"
42 "	"	550 " 600	"	"	"
44 "	"	525 " 550	"	"	"
48 "	"	500 " 525	"	"	"
54 "	"	475 " 500	"	"	"
60 "	"	400 " 450	"	"	"
Upright saw,		150 " 180	"	"	"

Power to Drive Machinery.

4 *horse power* will drive elevating, bolting and conveying machinery for two run of burrs.

6 *horse power* will grind, on 4 feet burrs, 6 bushels of corn or 4 bushels of wheat per hour, if stones are in good order.

8 *horse power* will grind, on 4 feet burrs, 9 bushels of corn or 5½ bushels of wheat per hour, if stones are in good order.

10 *horse power* will grind, on 4 feet burrs, 12 bushels of corn or 7 of wheat per hour, or drive an upright saw at 180 or a 350 pound Beating Engine.

15 *horse power* will grind 18 bushels of corn or 11 bushels of wheat per hour, or drive a 500 pound Beating Engine.

20 *horse power* will drive two runs of burrs and all the machinery in a country mill.

20 *horse power* will drive a 60 inch circular saw, or three run of burrs, etc.

A cotton gin of 60 saws requires 6 horse power to gin 500 pounds of lint in 2 hours.

A sumac mill requires 15 horse power.

On a circular board saw,

15 horse power will cut from					4 to	6	thousand	feet	in 10 hours.
15 to 20	"	"	"	"	6 "	10	"	"	"
20 " 30	"	"	"	"	8 "	15	"	"	"
25 " 40	"	"	"	"	12 "	20	"	"	"

The "Perfection's" Rivals.

Just say "Perfection" to the builder or agent of certain rival water-wheels and amuse yourself by noting how like a red flag to an angry bull this simple word acts upon him. The wholesale abuse the "Perfection" will get will astonish you. You will be told that it is nothing but an "old scroll wheel" and a veritable "water-sucker," that it crowds to one side of the case, that it has never been tested, that it freezes up in winter time, and dozens of other similar falsehoods.

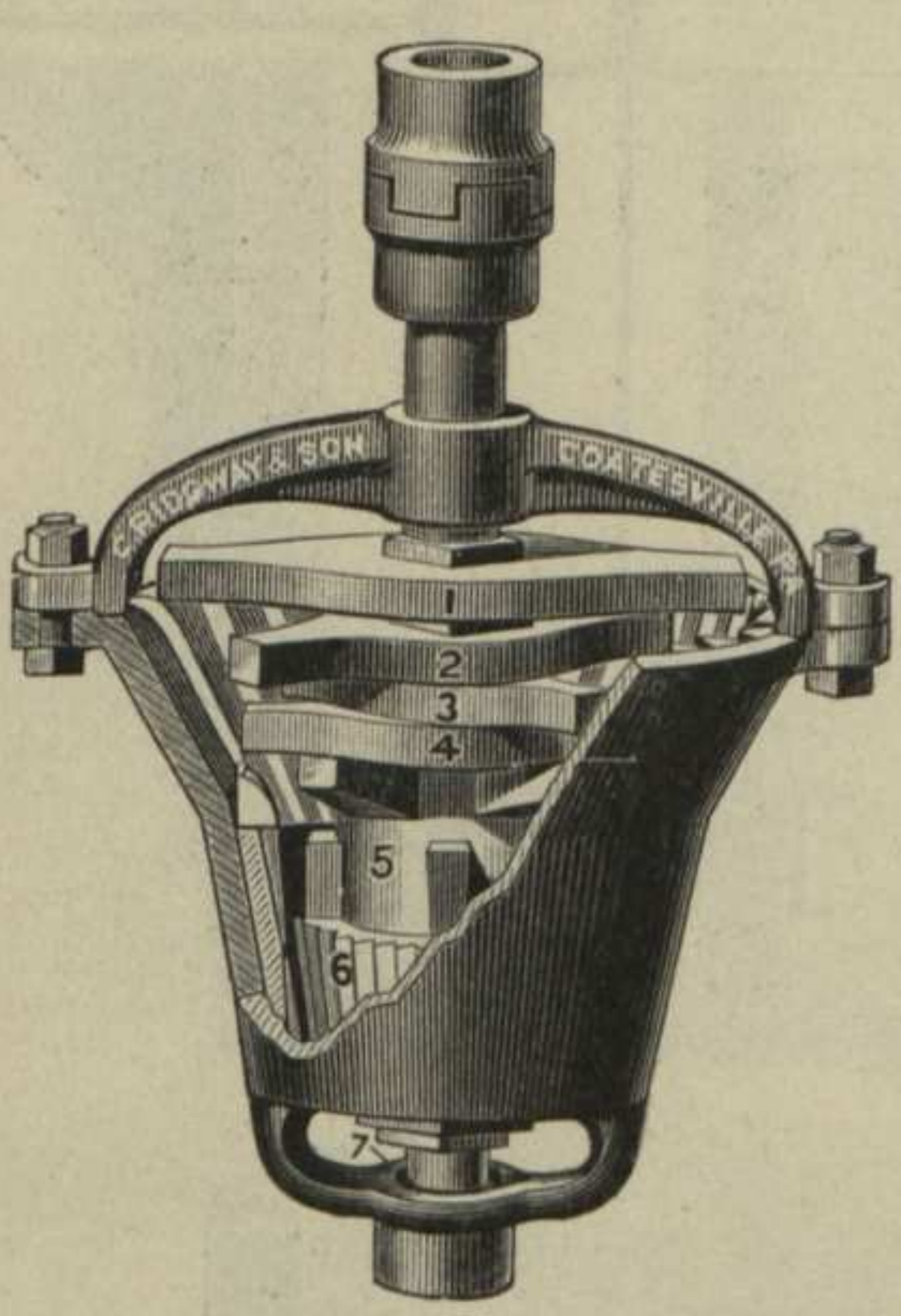
Yet, when you come to think of it, what better evidence of the excellence of the "Perfection" would you want than just this very abuse of it by a rival water-wheel man or his paid agent

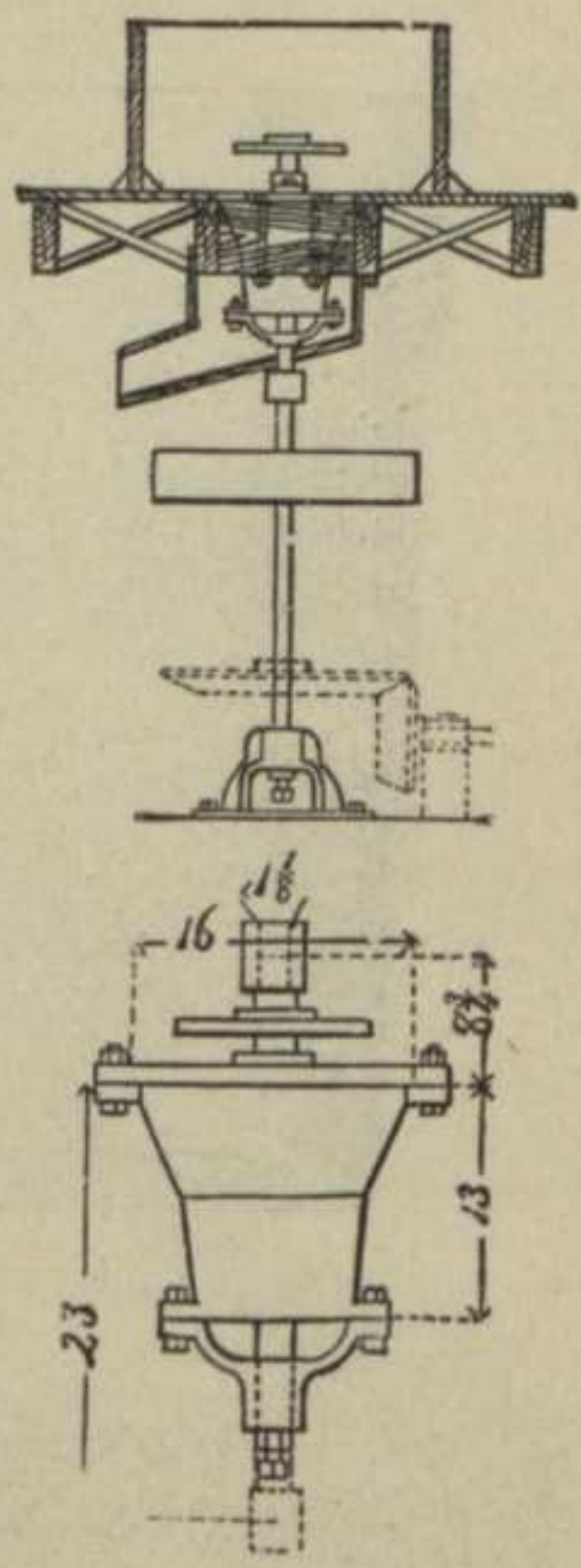
Why should he get so nervous and excited upon the bare idea of your putting a "Perfection" in your mill? If the "Perfection" were guilty of a single one of the many faults charged to it—not to speak of being guilty of all of them—why not encourage you to put it in? For as you do not pay for it until it does all we say in your own mill, before your own eyes, you would not be apt to keep it, if it shows any of the faults charged. You would throw it out and the other wheel man could set his wheel in its place. The "Perfection" surely has a great reputation. and just to think what a great advertisement it would be to beat the celebrated "Perfection" on its own test (see page 106).

Can you not guess the secret of the opposition to the "Perfection?" Other wheel-men know only too well by experience that the "Perfection," once introduced into your neighborhood, and mill-owners get a chance to witness its excellent performance and see its great economy in the use of water, no other kind of a wheel can be sold, except at a great reduction in price, even then only a few mill owners can be tempted by the low price of the clap-trap affairs.

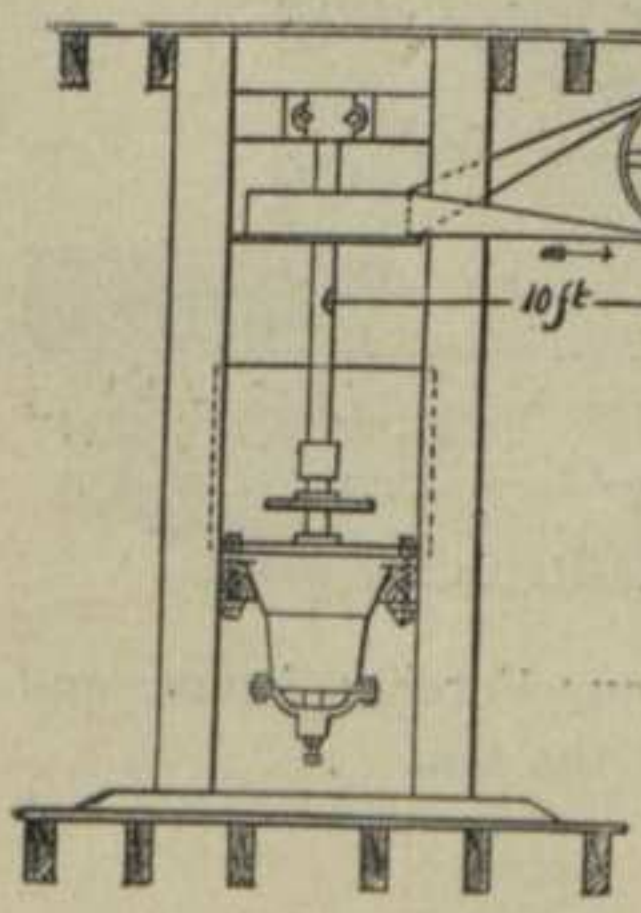
The agent who so bitterly opposes the "Perfection" would talk the other way if we would only pay him as big a commission as the other party. There are no big commissions in the "Perfection." This is its only fault. We have agents, it is true, but they are usually local millwrights, who recommend the "Perfection" because they honestly believe it to be the best. The profit they make is in the job you will probably give them of putting it in. In fact, the millwright who recommends the "Perfection" really works against his own interests, for the "Perfection," by needing no penstock, saves a big job of millwrighting. It is a very small matter to set a "Perfection," so small indeed that many mill owners dispense with a millwright altogether and do the work themselves with the help of a carpenter or day laborer.

Corn and Cob Crusher.

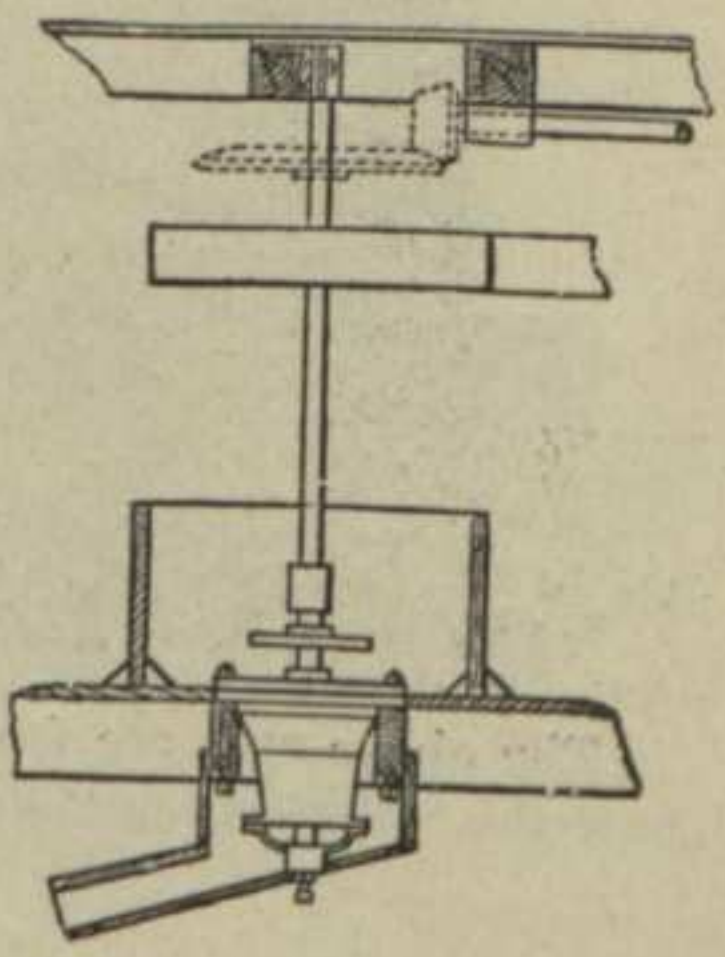


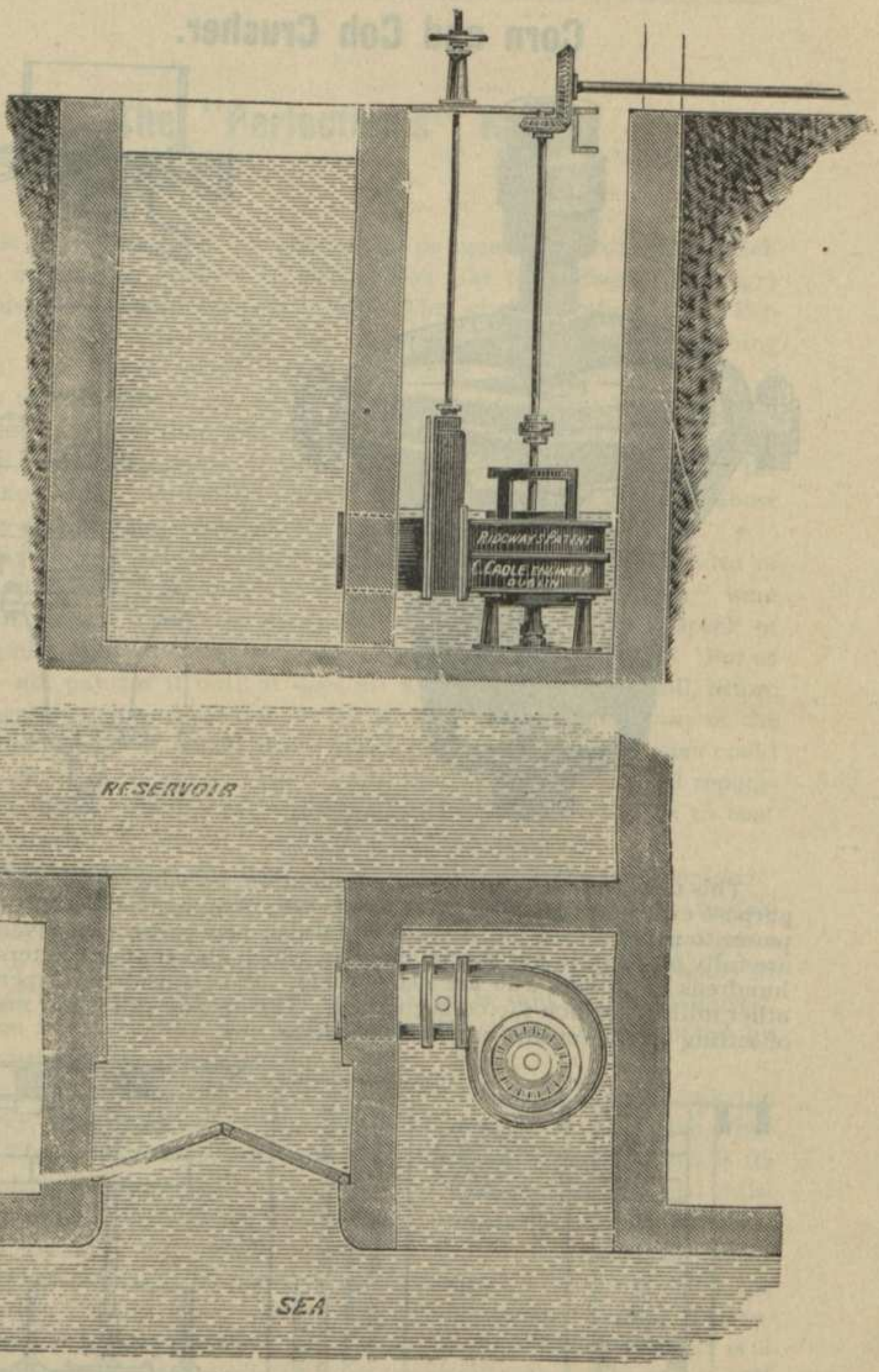


This machine has a world-wide reputation as being the best for the purpose ever invented. Its great points are: Requires only a half horse-power to run it; costs but a trifle to furnish new parts. Its advantages are fully set forth in our special circular, which also contains letters from hundreds of millers who are using them. It is considered superior to other mills for which $30.00 is charged. The outline cuts show manners of setting up the crusher and its dimensions.



Send for special circular if you are ever in need of such a machine to put ahead of your burrs for crushing corn cobs for cattle feed.

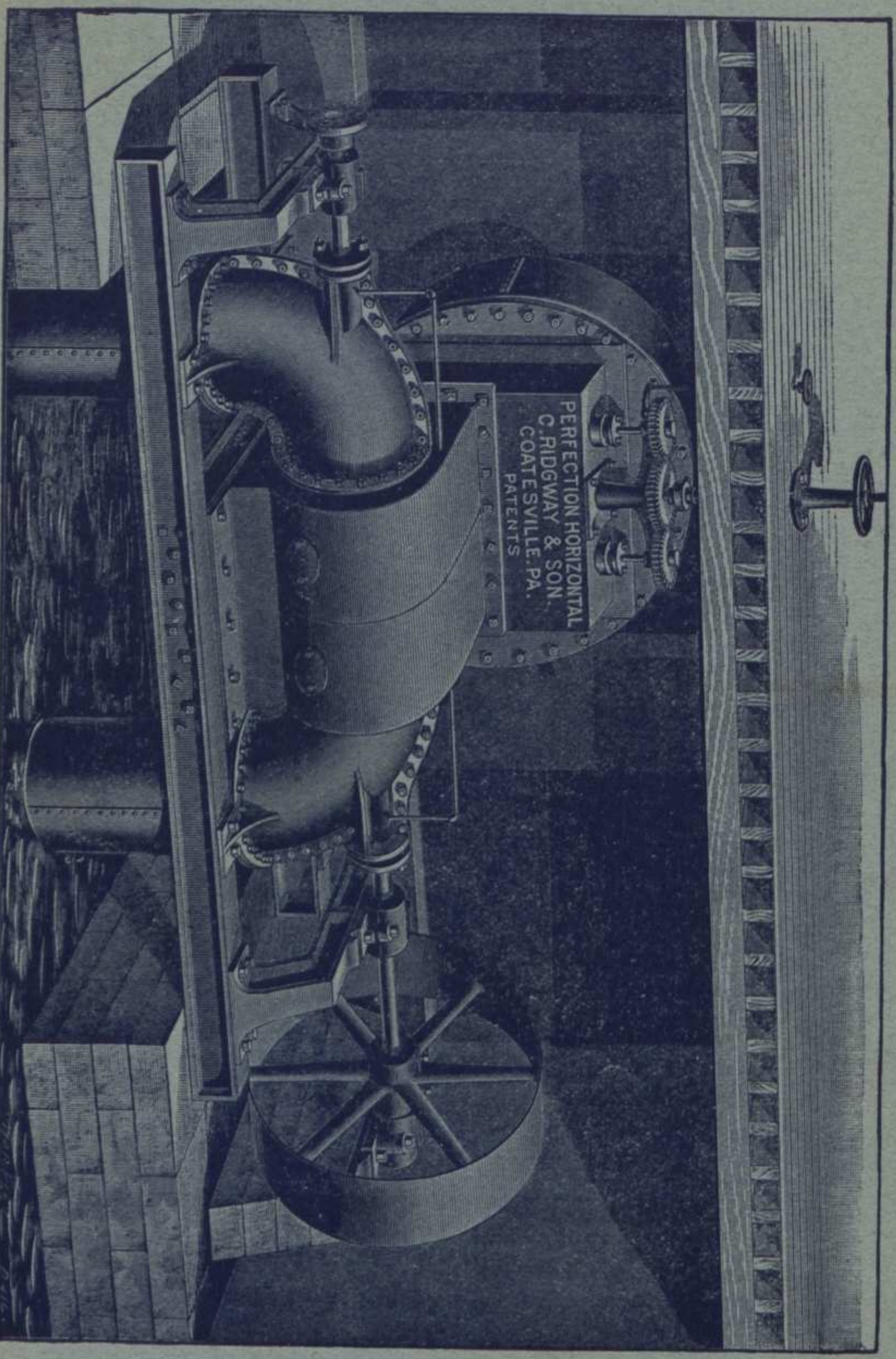




The above cuts are from the circular of our Foreign Agent, and show the "Perfections" driven by the tide of the sea.

ELEUTHERIAN MILLS HISTORICAL LIBRARY

Trade
Cat



DANDO PRINT, PHILADELPHIA.